APRIL. 1980
$1.60* NZ $1.75

eti ELECTRONICS TODAY INTERNATIONAL

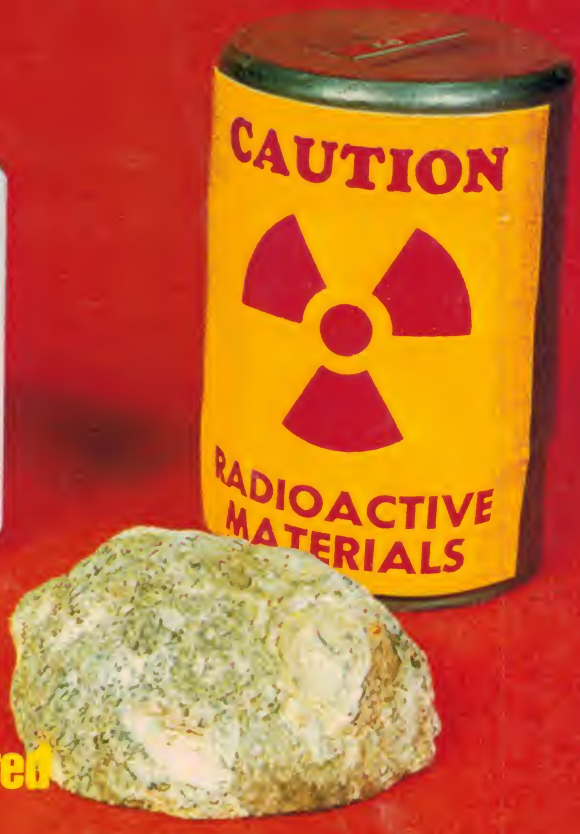
RADIOACTIVE?
Geiger counter to build

Check Dick Smith catalogue inside!

The Very Large Array
Probing the edge of space

Pipe & cable locator
Find them before you dig!

HI-FI Features
Wow & flutter - how low to go?



Brilliant Accuphase E-203 amp reviewed plus Marantz 2600 receiver.

A new dynamic generation of Maxell tapes.

When Maxell announces an improvement in the quality of its tape, you can bet the improvement has to be pretty dynamic. In fact, we think our new generation has even gone beyond our own standards of superior sound reproduction.

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For details on all Maxell Recording Tape write to
Maxell Advisory Service, P.O. Box 307, North Ryde, N.S.W. 2113

Available time length UD-XL I: 60, 90 min./UD-XL II: 60, 90 min.
UD: 60, 90, 120 min./LN: 60, 90, 120 min.

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WT126/79

ELECTRONICS TODAY INTERNATIONAL

Registered for posting as a publication — Category B

QUICK INDEX

I LEARNED RECENTLY that ethnic TV broadcasting is to commence in Sydney and Melbourne later this year. It is something for which the proponents have fought for some time. However, their dream may turn out to be something of a nightmare.

The broadcasts will be transmitted on television channel 0 (45 MHz to 52 MHz).

Melbourne's ATV-0 recently vacated channel 0 and moved to channel 10. Propagation and interference problems apparently contributed to the decision to move. Ever since they commenced transmission in the early '60s, reception was dogged by a number of problems. Primary service area propagation problems were apparent throughout the life of the station, some areas experiencing very poor reception. For many viewers these problems were aggravated by the fact that many receiver antennas did not exhibit good response at the frequencies involved.

During the summer months, ionospheric propagation brought (brings !) co-channel interference problems; sometimes from channel 0 Brisbane (and in Brisbane, from channel 0 Melbourne), despite frequency offsets of the vision and sound carriers, sometimes channel 1 transmitters in New Zealand (44 MHz to 51 MHz) caused problems for viewers.

When CB came along, guess which channel was reported to suffer from the most interference ? The combination of a weak signal and a poor antenna contributes greatly to front-end overload in a TV receiver from a nearby CB transmitter. Secondly, the second harmonic from a 27 MHz CB transmitter, at 54 MHz, is sufficiently close in frequency to channel 0 to further aggravate the problem. There are many, many older type CB rigs still in use that have quite high levels of second harmonic output.

Surely those involved in allocating channel 0 to ethnic broadcasting are aware of the potential problems ? I learned, with dismay, that those in charge of the new service were not appraised of the potential problems.

I understand that the transmitters for the ethnic service will radiate a lower power signal than the main TV stations. It doesn't take much 'nouse' to figure out the service problems Sydney is likely to experience ! Few, if any, TV antennas in Sydney are made to cover channel 0. The aforementioned problems arising from weak signals and poor antennas, not to mention Sydney's known 'shadowing' problems, bodes ill for the likely viewers.

It seems to me that the allocation of channel 0 was not merely shortsighted, but done as a political expedient. Last year we were told that ethnic broadcasting was to commence on UHF. This change of plans may see an early commencement of the service, but may also contribute to an early demise.

An urgent review is necessary.

Roger Harrison, Editor

advertisers

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COVER

David Tilbrook's geiger counter project graces this month's cover — designed and photographed by Ivy Hansen, as usual. That rock in the foreground is a lump of agate from Jamye Harrison's collection.

news

features

projects

sound

general

next month

RADIOMETRIC EXPLORATION
How geophysicists use radiation detectors in mineral exploration.

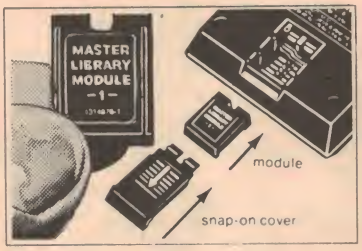
140W VALVE AMPLIFIER MODULE
Our *first* valve project . . . you thought we'd *never* do it, didn't you? If you like that 'warm' sound — this amp will suit pop groups and may also interest the valve hi-fi buff.

VEHICLE TEST PROBE
A handy gadget for fault finding in cars. It tells you whether a certain test point is floating, live with 12V, connected to 12V via an impedance, or grounded.

S.A.E. 3000 PREAMP AND 2200 POWER AMP REVIEWED
Operational flexibility and solid performance are the features of this pair of American-made units. ". . . we soon found that the designers had done a very good job in providing a degree of functionality greater than the average user could reasonably ask for".

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

Now the business professional has an extra-ordinary programmable calculator from Texas Instruments.



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Tilting at windmill power

Whilst wind power seems to be one of the most promising of the 'renewable' energy sources at present, with many research programmes under way throughout the world, behind those gently twirling windmill blades lies some potentially enormous problems.

Glyn England, chairman of the Central Electricity Generating Board in the UK, has warned people against taking a romantic view of wind power.

"An aura of romance surrounds the subject of wind power in the minds of a large section of the general public, which thinks in terms of the picturesque windmills of former centuries," he said. "The reality is in stark contrast.

"The successors of the old windmills will not be windmills at all: they will be grinding out power, not flour. So it is more accurate to call them wind machines or wind generators.

"There will be many other differences, too. The power of the traditional windmill was about 40 kilowatts; to reduce generation costs, the modern wind machine will probably be very much bigger, with an output up to 100 times greater. An industrial consortium led by British Aerospace Corporation has, in fact, produced for the Department of Energy a design for a 3.7 megawatt machine. This has two blades, each 100ft long — slightly longer, that is, than the wing of a Jumbo jet — and they are mounted on a 150ft high tower.

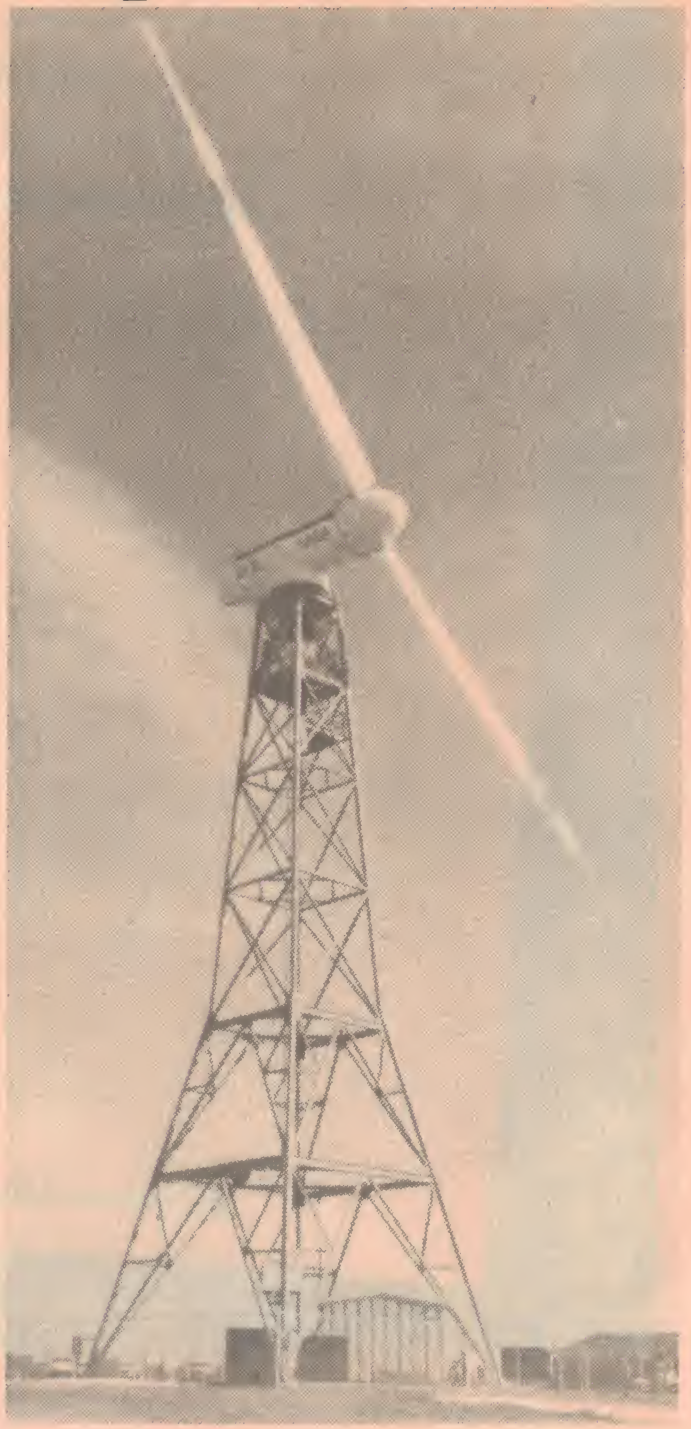
"In appearance, too, the wind machines will be singularly lacking in old-world charm. Various designs have been produced. Some are very like transmission towers, and about the same size as our largest. Another design resembles a 10-storey tower block with a propellor at the top. In order to get maximum output they would have to be sited in windy areas, the most obvious being exposed hilltops, and most of these are in beauty spots. The number of suitable hilltops in Britain is limited — perhaps 1500 or so — and about 2000 large machines would be needed on a thousand hilltops to match the annual output of a single large power station. Moreover, since the wind does not always blow, back-up generating capacity would still be required.

"The environmental implications of all these factors are obvious."

A way round the difficulties, said Mr England, would be to site the machines offshore — for example, in the North Sea shallows off the East Coast. There they would be much less obtrusive.

"Plenty of energy is available offshore. Wind-speeds are higher there than over open land, though not as high as on the best hilltop sites. Admittedly, it would be more difficult and costly to build and maintain the machines offshore than on land. There would also be the extra expense of getting the power ashore. Another drawback is that they could be a hazard to fishing vessels. Nevertheless, we think that offshore siting is an exciting possibility, and we have joined with the Departmental of Energy and an industrial consortium to study the technical problems and costs involved.

"As part of this project, we at the CEGB are seeking to determine how much energy is potentially available over the North Sea. In collaboration with British Petroleum and the National Maritime Institute, we have installed special instruments on a gas-production platform in the North Sea so that we can obtain data on wind speeds. Other work is going on at our Leatherhead laboratories, where we are carrying out tests in a wind tunnel to find out how closely together wind machines could be sited without taking the wind out of each other's sails. In addition, we are studying how wind machines could be integrated into our (grid) system. Provided that large machines strong enough to withstand gales and heavy seas could be developed, it might be possible to supply a proportion of Britain's electricity demand in this way."



Although wind power and other 'renewable' energy sources, notably wave power and tidal energy, might be "helpful" as we moved into the next century, none of them, on present figures, were likely to produce low-cost energy, said Mr England.

CSIRO role in space mission

Solar scientists from CSIRO's Division of Radiophysics are collaborating with US space scientists in space mission to study the Sun.

The experiments are to be carried out as part of NASA's Solar Maximum Mission — the name given to the space craft launched from the US in mid February.

The Mission is expected to provide more information on the Sun than all the previous space-based observations combined, including the Skylab mission which came to an end over Australia last year after recording a large amount of data on the sun.

The Solar Maximum Mission will enable scientists to study sunspots and solar flares and other phenomena during 1980, the period of maximum activity in the current sunspot cycle.

One of the CSIRO scientists involved, Dr Kevin Sheridan, explained that sunspots were cooler regions with exceptionally strong magnetic fields on the Sun's surface, while solar flares were sudden and violent explosions in the Sun's atmosphere near sunspots, sometimes releasing as much energy as the simultaneious detonation of 20 million 100-megaton H-bombs.

"CSIRO's solar scientists are particularly interested in an experiment which will show what happens in the Sun's gaseous corona or atmosphere after some of the larger flares," Dr Sheridan said.

"An instrument called a coronagraph is being carried on the space craft and this will enable scientists to study the structure and physical properties of parts of the solar atmosphere that have not yet been properly explored."

Australian scientists will make observations at CSIRO's solar radioastronomy observatory at Culgoora in NSW simultaneously with those from the spacecraft.

"The Culgoora observatory takes radio pictures of the sun and these images will be compared with those coming from the spacecraft," Dr Sheridan added.

The images are made at Culgoora with the radio heliograph which used 96 aerial equally spaced around a circle of three kilometres diameter.

"This is one of CSIRO's many complex instruments which enable astronomers to learn more about the Sun and ways in which its energy processes might be developed on earth to benefit man," Dr Sheridan added.

The Solar Maximum Mission's satellite is expected to stay in orbit for about 12 months and possibly be recovered by the US space shuttle to be launched later this year.

LED VU meter

The type VUM is a mono VU meter intended for use in any equipment where VU or ppm indicative metering is needed.

The meter utilises logic control circuits which give very fast rise and decay time. The housing is made of tough moulded plastic with a tinted acrylic front and is designed for panel mounting with the display protruding through the panel aperture. The display can also be illuminated by fitting bulbs light enters via the sides of the transparent covers.

The power supply required is 12-15 Vdc and the current drain is 40 mA for mono, 80 mA for stereo. The frequency response is 20 Hz to 100 kHz with a tolerance of plus/minus 1 dB. The stereo version is similar to the mono version, except that it incorporates two rows of LEDs.

Further information can be obtained from Delsound Pty Ltd, 1 Wickham Tce, Brisbane Qld 4000. (07) 229-6155.

Briefs

NASA's launch fee for the Space Shuttle is destined to escalate to the stars by the time they get it off the ground. Originally scheduled for its first launch in June, the project has slipped somewhat with technical problems dogging its final stages. The present launch cost is in excess of US$31 million (1979 dollars!), growing weekly. An expendable Delta booster launch would cost around 2/3 of that, for a typical commercial communications satellite. Even when flight rates are amortised over the expected average 40-a-year launch rate (487 flights over 12 years), costs are far in excess of those for present methods used.

Have they designed an expensive, ceramic-tiled flying white elephant?

A would-be robber at the premises of Perth gold merchant Van Harn Gold found the price of gold too high — he was arrested before he got inside the building. The speedy arrest occurred with the help of Computa-Guard, the Australian-made computerised security system (see ETI, July 1979, p.124) installed in all Australian capital cities by Metropolitan Security Services. The 'break and entry' alarm was activated at Van Harn Gold at 1.06 am. The Computa-Guard central station notified Patrol Officer Peter Burns, who — despite being involved in a minor accident — was at the premises four minutes later. He reported that, although a window was broken, no entry was gained — and an offender was running along the street. The police, notified of the alarm at 1.09 am, were on the scene three minutes later and had arrested the offender by 1.16 am.

Crime does pay — for MSS at least!

'Inductors on a chip' have been developed by TDK. The inductors are made of alternate layers of conductor and dielectric in a manner similar to that used to make multilayer chip capacitors except that the conductor on each layer is patterned to form one turn of a coil. These are then series connected to form a continuous multiturn coil. TDK have produced inductor chips 3.2 mm long by 1.6 mm wide by 0.6 mm high with inductances between 10 nH and 2.4 uH. Larger chips, 4.8 x 2.4 x 1 mm exhibit inductances ranging from 2.4 uH to 50 uH, later to be extended to 220 uH. The devices are limited to applications where their minimum Q of 10 can be tolerated.

The release of the BY448 and BY458 now completes Philips' range of new generation parallel efficiency diodes for televisions and data graphic displays. These rugged, low-cost diodes have a double-diffused passivated crystal in an hermetically sealed glass encapsulation, with the crystal hard soldered to the molybdenum studs.

The range of diodes now comprises the BY228 and BY438 in SOD-64 encapsulation with repetitive peak reverse voltages of 1500 V and 1200 V respectively, and the BY448 and BY458 in SOD-57 encapsulation also with reverse voltages of 1500 V and 1200 V respectively. Further information from Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW.

A plug for safety

To help reduce the incidence of fatalities in the home and elsewhere, Swann Electronics Pty Ltd have released a power point safety checker.

This PPSC, which is recommended by the Housewives Association of Victoria, may be used to minimise the risk of electrical shock and damage to electrical appliances and is an ideal service tool for anyone who uses electricity in the home or industry.

Just plug the PPSC into any power point or extension cord and the two red indicating lights will show if correctly wired or if there is a fault and if so, what it is.

The Swann Power Point Safety Checker is available from all leading retail outlets and selected hardware stores.

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YN-360TR ST-303TR ST-350 ST-300 SP-10D ST-5

YN - 360 TR $21.70 plus tax

SPECIFICATIONS

Measurement Ranges:

DC V 0-0. IV-0.5V-2.5V - 10V-50V - 250V - 1000V (20KΩ /V)
AC V 0-10V-50V-250V-1000V (8KΩ /V)
DCmA 0-50μA-2.5m A-25m A-0.25A
50μA at 0.1V DC position

Resistance Range	X1	X10	X1K	X 10K
Minimum	0.2	2	200	200K
Midscale	20	200	20K	200K
Maximum	2K	20K	2M	20M

dB-10dB ~ + 22dB for 10V AC
Battery: 1.5 X 2, 9V X 1

Accuracy:
DC V & mA: within ± 3% F.S.
AC V: within ± 4% F.S.
ohm: within ± 3% Arc

Dimensions & weight 147 x 100 x 45mm 430g

ST-303TR $30.39 plus tax

SPECIFICATIONS:

DC Voltage: 0.0.3, 1.5, 3, 12, 30, 120, 300, 1200 Volts 20k Ω /V.
AC Voltage: 0.6, 30, 120, 300, 1200, 8k Ω /V.
DC Current: 0.0.06, 3, 30, 300mA, 12A.
Ohms: 0.20 Megohms In 4 Ranges ± 3%. 20 ohms center Scale
Decibels: – 10 to + 17.
Transistor checker: Iceo (L1) 0-150μA on x 1KΩRange; 0-15mA on x 10ΩRange; 0-150mA on x 1ΩRange; hfe 0-1000 on x 10ΩRange IC/1B

ST-350 $16.48 plus tax

SPECIFICATIONS.

Range of Measurement

DC Voltages: 10V 50V 250V 500V 1000V (2KΩ /V)
AC Voltages: 10V 50V 250V 500V 1000V (2KΩ /V)
DC Current: 0.5mA 25mA 500mA 10A
Resistance:

Range	X1	X10	X 1000
Midscale	20Ω	200Ω	10KΩ
Maximum	500Ω	5KΩ	1MΩ
Minimum	0.2Ω	2Ω	200Ω

Volume level: 20 ~ + 22dB & + 20 ~ + 36dB
Capacity: 0.0001 ~ 0.03μF & 0.01 ~ 0.6μF
Inductance: 10~1000H
High resistance: 0.1~50MΩUse external power
Batteries. Two 1.5V dry cells (UM-3 or equivalent)
Allowance. DC Voltage & Current: Within ± 3% f.s.
AC Voltage: Within ± 4% f.s.
Resistance: Within ± 3% of scale length
Size & weight. 138x96x51/mm 480g

ST-300 $38.70 plus tax

SPECIFICATIONS:

Range of Measurement:
AC Amperes (AC A): 6A 15A 60A 150A 300A
AC Voltages (AC V): 150V 300V 600V
Resistance ( ): 1kK (centre: 30)
Tolerance:
AC Ampere: 3% of maximum graduation.
AC Voltage: 3% of maximum graduation
Resistance: 3% of Scale length.
Inside Battery and fuses of Resistance Range 1 piece UM-3 Battery, 1.5 Volts 3 piece 0.1A Fuses In a Glass Tube (9.5–11.5)

SP-10D $16.09 plus tax

SPECIFICATIONS

Measurement ranges.

DCV 0.25 10 50 250 500 1000 (4K Ω /V)
DCmA 0.25 25 500 (250mV drop)
ACV 10 20 250 500 1000 (4K Ω /V) 50

Ω Range	- X1	X10	KΩ
Midscale	-20	200	10K
Maximum	- 500	5K	1M
Minimum	- 0.2	2	200

Battery - 1.5VX1
dB – 20 ~ + 22 +20 ~ +36 ~ +62
MΩ0.1 ~ 50 using external
uF 0.0001~0.02 0.01~0.3 power
Accuracy. Within ± 2.5% fs for DCV & mA: Within ± 3.5% fs for ACV; Within ± 3% of arc for Ω
Dimensions & weight 140x95x44mm & 310gr.

ST-5 $11.74 plus tax

SPECIFICATION

Range of measurement

DC Voltages: 5V 25V 250V 500V (4K Ω /V)
AC Voltages: 10V 50V 500V 1000V (2K Ω /V)
DC Current: 250μA 250mA.
Resistance: 0 ~ 600K (7000 ohm center)

Allowance:
DCV and DCA: within ± 3% f.s.
ACV: within ± 4% f.s.
ohm: within ± 3% arc
Size and weight: 90x60x28/mm 120g.

AND GOODWILL TEST INSTRUMENTS

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AUDIO GENERATOR
Model: GAG 808A

•SPECIFICATION

• SINE WAVE CHARACTERISTICS

Output Voltage: 7V rms or more (when no load)
Frequency Characteristic: 10 HZ to 1 MHZ ±0.5 dB (reference frequency: 1 KHZ)
Distortion Factor: 400HZ to 20KHZ. 0.1% or less; 100HZ to 100KHZ 0.3% or less 50HZ to 200KHZ. 0.5% or less; 20HZ to 500KHZ. 1% or less; 10HZ to 1MHZ. 1.5% or less

• SQUARE WAVE CHARACTERISTICS

Output Voltage: More than 10V P-P (when no load)
SAG: 5% or less (at 50 HZ)
Rise & Fall Times: Less than 200 nS
Overshoot: Less than 2%
Duty Ratio: 50% ±5%

• EXTERNAL SYNCHRONIZATION CHARACTERISTICS

Synchronizing Range: More than 1V ±1%
Max Allowable Input: 10V RMS
Input Impedance: 10K Ohm
Output Impedance: 600 Ohm ±10%
Output Attenuator: 0 to 50 dB, 6 steps, each step decrease. 10 db. (less than ± 1 dB)
Frequency Variation: Less than ± 0.5% AT AC 110V ± 10%
Operation Temperature: 0-50C (relative humidity: less than 90%)
Power Source: 110V/220V ± 10% (AC) 50HZ/60HZ
Dimension: 142 (W) x 240 (D) x 197 (H) mm
Weight: 4.5 kg.

AC MILLIVOLT METER
Models: 3VT-706

HIGH SENSITIVITY

RMS Scale: 1mV-300V (Full Scale) in 12 Ranges. (GVT-706A); 1.5mV-500V (Full Scale) in 12 Ranges. (GVT-706B)
dBM Scale: – 60db ~ + 50db In 12 Ranges
Input Impedance: 10M Ω on all Ranges.
Accuracy: ±3% of Full Scale at 1KHz
Frequency: 10Hz-500KHz ±3%
Response: 5Hz – 1MHz ±5%
Output: About 1V at Full Scale Indication
Distortion: Less Than 2%
Dimension: 142 (W)x205 (H) x 230 (D) (mm)
Weight: 3kg

$173.04 plus tax

$237.00 plus tax

$173.00 plus tax

GOS-935 GOS-955

OSCILLOSCOPE
Models:

GOS-935

Vertical Deflection: Sensitivity: 10mV/DIV Attenuator: 1/1, 1/10, 1/100, and GND. Bandwidth: DC:DC–5MHz(–3dB). AC:2Hz–5MHz(–3dB). Input Impedance: 1MΩ± 5% Within 35PF. Max Input Voltage: 600VP-P or 300V(DC + ac peak).

Horizontal Deflection: Sensitivity: 250mV/DIV. Bandwidth: DC–500KHz (–3dB). Input Impedance: 1M Ω ±10% Within 35PF
Time Base: Sweep Frequency: 10Hz–100KHz in 4 ranges and fine control. Linearity: Less than 5% Synchronizing: Internal and external
Synchronization: Type of sync: INT, EXT. Sync Amplitude: INT: more than 1 DIV on the screen. EXT: more than 2VP-P

GOS-955

Vertical Deflection: Sensitivity: 10mV/DIV. Attenuator: 1/1, 1/10, 1/100, and GND. Bandwidth: DC: DC-5MHz(-3dB); AC: 2Hz-5MHz(-3dB). Input Impedance: 1M Ω ± 5% Within 35PF. Max Input Voltage: 600VP-P or 300V(DC+ac peak).

Horizontal Deflection: Sensitivity: 250mV/DIV or better Bandwidth: DC–500KHz(-3dB) Input Impedance: 1M Ω ± 10% Within 35PF

$400.00 plus tax

FREQUENCY COUNTER
Model: GFC 876

SPECIFICATIONS

Frequency Range: 10Hz-70MHz
Input Sensitivity: 20mV, 200mV rms selected by sensitivity switch.
Input Impedance: Approx 1 M Ohm, under 25 pf.
Input Destroyed Voltage: 150V rms.
Coupling System: AC Coupling
Oscillation Frequency: 10 MHz
Aging Rate: 1x10-6 week
Temperature Stability: 5x10 + (25 + 5°C) 4x10 (Calibration ambient temperature 0–40°C)
Measurement Accuracy: ± 1 count ± standard time base accuracy
Counting Capacity: 6 digital decimal.
Counting speed: Max 70 MHz
Display system: Digital display LED, display storage with overflow indication.
Resolution: 100Hz (10 ms) or 1Hz (1S)
Operating temperature range: 10 – +45°C
Power Cosumption: Approx 15VA
Power Requirement: AC 110V/220V, 50/60Hz
Dimensions: Approx 175 (W) x 75 (H) x 260 (D)mm
Weight: Approx 2.5kg

Frequency Range: x 1 range - 10HZ to 100HZ: x 10 range - 100HZ to 1KHZ: x 100 range - 1KHZ to 10KHZ; x 1K range - 10KHZ to 100KHZ; x 10K range - 100KHZ to 1MHZ (5 Ranges)
Frequency Accuracy: ± (3% + 1HZ)

Time Base

Sweep Frequancy: 10Hz to 100KHz in 4 ranges and the fine control. Linearity: Less than 5%, Synchronzing: Internal and external
Synchronization: Internal – & + : external; line 0-140 for line frequency sweep.

Sales tax is 15 percent if applicable.

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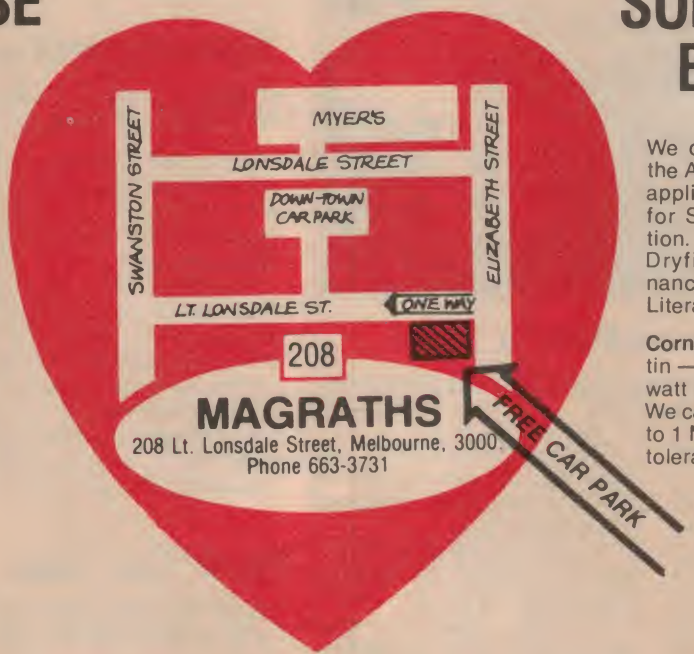
DIP compatible pins. Solvent resistant plastic case.



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NEWS digest

Speakeasy for Australia

An Australian-designed push-button, 50-number memory telephone has been launched here.

Called the Speakeasy, it is the only telephone communications device approved by Telecom to offer a host of inbuilt features including PABX compatibility, loudspeaker operation and automatic redial, say the Australian agents, Systems Automation Micronic Pty Limited of Crows Nest.

The telephone was designed and manufactured in Australia by Hypercom Pty Limited and is claimed to introduce an entirely new concept in telephone communication.

The Speakeasy features push button operation, a 'hands free' conference loudspeaker facility with good tonal reproduction, and is claimed to be the only telephone available in Australia to offer a 50-number memory.

The automatic redial can be activated with one button to contact an engaged number on a continuing basis.

It is easily installed, and is available on a lease plan from as little as $3.50 a week.

Outright cost of the Speakeasy is $495 including 50 number memory, Most imported machines only offer a maximum 28 number memory.

The set is powered from 220 Vac and during the absence of mains power will operate normally except for accessing numbers stored in the internal memory. These are retained, but are not accessible until external power is restored.

Further information may be obtained from Geoff Quayle in NSW on (02) 909-3137.

New printers handle passbooks

Special printers for application in banks, building societies and similar financial institutions, are to be marketed here by Anderson Digital Equipment.

Made by Okidata, under contract to Financial Network Architects, of La Jolla California, the printers accept passbooks and other transaction documents without requiring adjustments by the teller.

The machines adjust automatically for form size and thickness and also include a locked journal tape to record each transaction. The units print upper and lower case characters bidirectionally at 110 cps, with expanded font capability.

The system includes teller and administrative display terminals, printers, keypads and magnetic stripe readers for personal identification. A branch controller manages these devices and communications with a central host computer.

The dual operator controls of the Okidata CP210 allow two tellers to share each printer in typical installations.

The Okidata CP210 passbook printer together with the Oki range of printers are marketed in Australia by Anderson Digital Equipment Pty Ltd, P.O. Box 322, Mt Waverley Vic 3149 (03) 543-2077.

Splashproof switches

Indoor and outdoor applications are increasingly requiring spillproof and splashproof switches.

Since space is always at a premium, the sealed, ultraminiature 'Series 39' pushbutton switch by Grayhill, satisfies both requirements.

The SPST-N/O switch measures only 9 mm behind panel; the SPST-N/C switch, 13.4 mm behind panel. Both switches are only about 8 mm in diameter.

These sealed switches are momentary butt-contact types and rated to make and break 1/2 amp (SPST-N/O) and 1/4 amp (SPST-N/C) for 250 000 operations.

The SPST-N/O has moulded-in terminals to resist flux entry into the switch. A long migration path reduces the possibility of flux contamination in the SPST-N/C version.

Additional information is available by writing to the National Sales Manager, ACME Engineering Company Pty Ltd, 2-18 Canterbury Road, Kilsyth Victoria.

New fuse line

The Jackson brand of cartridge fuses were released recently by IFTA Australia Pty Ltd.

The 14-100 series glass cartridge instrument fuses come in a 5 x 20 mm cartridge rated for 250 V operation. They are fast-acting wire fuse types designed for use in circuits with low to medium current loads in ratings from 100 mA to 5 A.

The 14-200 series come in a 6 x 32 mm glass cartridge and are medium fast-acting metal strip fuses intended for automotive applications in low voltage circuits to 32 V. They are available in current ratings of 2,3,5,8,10,15,20,25 and 30 amps.

The 14-300 series come in 6 x 32 mm packages and are wire fuses suitable for general applications in 250 V circuits and come in ratings from 250 mA to 15 amps.

Fuse holders to suit are also available. Contact IFTA, 1 Greville St, Randwick NSW 2031. (02) 665-8211.

Portable spectrum analyser

Tektronix is introducing the 492 spectrum analyzer to Australia. This portable instrument is small, lightweight and rugged, yet Tektronix notes the 492 affords spectrum analyzer users the first capability to go beyond 60 GHz.

Stated frequency coverage is: 50 kHz to 21 GHz with internal mixers, 21 GHz to 60 GHz with external Tektronix waveguide mixers, and to 200 GHz with commercially available waveguide mixers. The highest range available in most spectrum analyzers is 40 GHz.

The 492 is designed for easy operation. The instrument uses a three-knob sequence for frequency, frequency span and reference level settings. At power on, an automatic sequence provides maximum input attenuation plus vertical and horizontal control settings, thereby assuring a repeatable start-up reference sequence.

Optional digital storage and signal processing further enhance the instrument's ease of operation. Simplification for the user is designed into the constant tuning rate frequency control, which the company notes allows positioning the signal with more convenience than experienced in conventional methods.

Laboratory performance, not usually available in a portable instrument, is a strong feature of this new instrument. Performance levels considered of particular interest are: 1) -123 dBm average noise level at 100 Hz resolution; 2) on-screen dynamic range of 80 dB, with 100 dB measurement capability in the preselected ranges; 3) 70 dBc low phase noise at 3 kHz offset.

The 492 is also relatively small, measuring 120 by 327 by 499 mm.

Options for the 492 include phaselock stabilization, digital storage and signal processing, front-end preselection, and removal of the external waveguide mixer connection. The 492P, which is the IEEE-488 programmable version, can also be ordered when GPIB interface is desired.

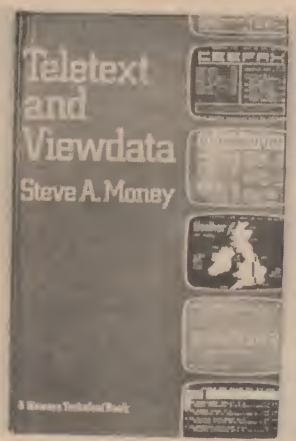
Full information available from Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde NSW 2113. (02) 888-7066.

Teletext text

A timely release from Butterworths recently was this little book on Teletext and Viewdata.

In 12 chapters, this book, by Steve A. Money, takes you from an introduction to the subject, through the theory of operation, descriptions of the various decoder systems to a look into the future.

Through primarily slanted towards the British system(s) the book is nonetheless packed full of informative material. If you want to find out about the subject in depth, this book is worth a close look.



Teletext and Viewdata costs $17.60, has 151 pages, a hard cover and measures 144 x 225 mm. Butterworths are located at 586 Pacific Highway, Chatswood NSW 2067. (02) 412-3444.

Errata & Omissions

March '80 issue: Tom Moffat's RTTY article suffered from some vital copy disappearing from the artwork during production. On **Figure 7** (page 57), all the transistors (Q1 to Q8) are small signal types such as BC107, BC547, BC108, BC548, 2N3564 etc. The UART may be an MM5303N or equivalent, while IC1, IC2, IC4 and IC5 are all type 4001 and IC3 is a type 4000.

In the **Speaker Protector project** (ETI-455), on page 41 there is a note on the circuit diagram that says "D1-D4 are 1N914; D5, D6 are 1N4004". This is incorrect, expunge it forthwith, the parts list shows them correctly.

Handy component packs

Philips are to market a series of component kit packs through their 'Philips Service' outlets around the country.

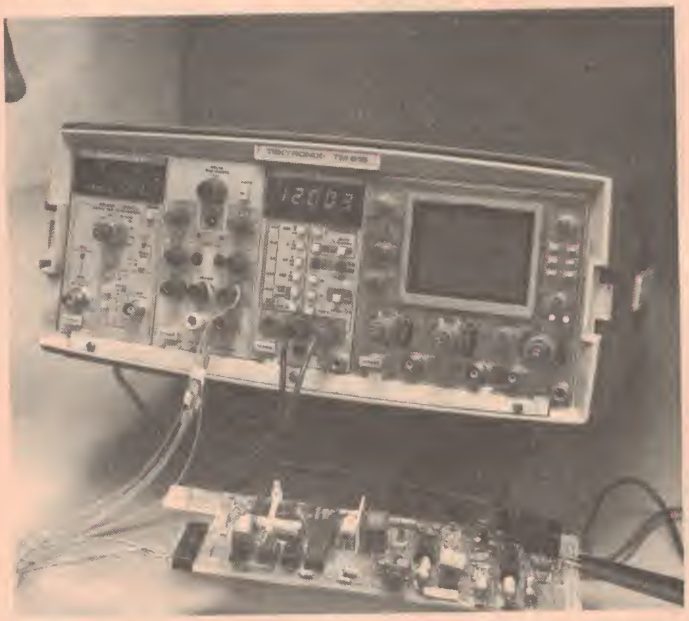
The packs consist of sets of resealable polythene plastic bags containing a number of components of a particular type or value.

Philips have available a variety of transistor kits, resistor kits and capacitor kits as well as a hardware kit. The latter contains the popular sizes of BA nuts, bolts and washers, some small drills and a tap with handle. The transistor kits include quick reference data.

Check your local Philips Service outlet for price and availability.

NEWS digest

Seven-function versatility from new DMM



Tektronix say their new DM 501A digital multimeter is the only DMM to combine 4 1/2 digit resolution with the versatility of seven measurement functions

Basic ac and dc voltage, ac and dc current and resistance measurements are supplemented by dBm and dBV measurements and by temperature measurement with a probe from -62 degrees to +240 degrees (centigrade). Readings on the ac scales are true RMS. The DM 501A offers full floating measurement capability.

New with the DM 501A is an expanded range for temperature measurement at the probe tip. This range is the widest available in a digital multimeter, say Tektronix. The entire probe, including cable, is specified for immersion at temperatures to 140 degrees. Small mass for low thermal loading and fast response to changing temperature is provided by a platinum film sensing element. A dome-shaped tip provides intimate contact between the probe tip and the surface to be measured.

DC voltage is measured on five ranges from 200 mV to 1000 V full scale. Maximum resolution is 10 V and accuracy is plus/minus 0.05% of rating plus 0.01% of full scale, depending on the range selected.

For ac voltages, five ranges may be selected from 200 mV to 500 V full scale. Accuracy is better than 0.6% of reading plus 0.05% of full scale (0.2% on 500 V scale) from 40 Hz to 10 kHz, and is 1% of reading plus 0.05% of full scale through the rest of the 20 Hz to 20 kHz operating frequency range. Readings are true RMS. Maximum voltage rating for the inputs is 1000 V peak between inputs or between either input and ground.

On the dB scale, any of five range settings (-40 dB, -20 dB, 0 dB, -20 dB, and -40 dB) may be selected. Accuracy is within 0.5 dB from 20 Hz to 20 kHz. Readout in either dBV of dBm can be selected.

Five ranges from 200uA to 2A full scale are selectable for measuring dc or ac current. Maximum resolution is 10 nanoamps.

Resistance can be measured on any of six ranges, from 200 ohms to 20 M full scale. A high-/low ohms feature allows the user to choose whether semiconductor junctions will be forward biased during in-circuit measurements.

In addition to its own performance features, the DM 501A operates in conjunction with the users' choice of more than 40 other TM 500 plug-in instruments to form a complete measurement system. These include counters, oscilloscopes, signal sources, power supplies, signal processors and oscilloscope calibrators. Any of six mainframes can be selected to house the DM 501A. Backplane wiring facilitates interconnection with other TM 500 instruments.

Tektronix is a leasing manufacturer of test and measurement and computer graphics equipment. An Australia wide network of sales and service centres is maintained to satisfy customer needs. Contact Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde NSW 2113.

Sharp 'microplanner'

The Sharp Corporation has introduced an executive microplanner which will allow a busy person to key in schedules and plans in advance and then be reminded at the appropriate time with an alarm and visual display.

The Sharp EL 6200 microplanner is also a full function calculator, a quartz alarm clock, information storage and a calendar with capacity to the year 2099.

The device has two displays. An upper section for numerals and lower section for letters, numerals and symbols. Display in the lower section is by means of a dot-matrix alphanumeric rolling writer function.

The alphabetical keyboard is set out the same as a typewriter (QWERTY) for ease of operation.

There are six symbols available — an aeroplane, telephone handset, car, a wine glass, a person walking and a group of two people. These are used in place of messages, to save space.

On command, the machine will display either monthly or daily planners using a dot matrix on which is indicated the time of appointments or engagements.

On another command a detailed analysis of these engagements can be obtained from the microplanner.

The Sharp EL6200 sells for a recommended retail price of $99.95.

Recorder range expander

The Model 5 Range Expander from McKee-Pedersen Instruments may be used with chart recorders, meters, and DPMs to automatically keep large signals on scale.

A major feature of the Model 5 is its ability to convert any recorder into a 1 mV sensitivity unit. It also changes single-range units to multi-range. Both positive or negative inputs are accepted from 1 mV to 1 V full scale. Output is selectable for 1, 10, 100 mV or 1 V recorders. Full zero suppression is provided.

For convenience, there is an output for an event market, as well as an LED indicator, to show you when over-range data are being displayed.

There are four operating modes: normal, normal with 10 x attenuation, foldover, and foldover with 10 x attenuation. The normal mode simply offsets the overrange signal by one chart width.

The foldover mode is less demanding. Here, the off-scale signal is folded and displayed upside down. The pen does not have to get back to zero before continuing its trace. If signals are likely to be very large, both normal and foldover modes may be used with 10 x attenuation.

All types of laboratories will find the model 5 useful for their data acquisition applications.

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S-100 SYSTEMS

Omega Configuration 1
Beehive DM-20 or Lear siegler ADM-42 serial terminal (80 x 25 full communications terminals) with Mainframe of 2 x Shugart SA801R double density (480k/drive), 64k Static RAM (4 Mhz with bank select), Delta Products Z80a CPU and Disk Controller, 2 programmable RS232c serial I/O ports, 3 x 8 bit Parallel ports. NDK S-2000 printer (bi-directional, 132 columns, 170 CPS, 15" paper, stand and interface). Software: CP/M version 2.1 and WORDSTAR (powerful editor/wordprocessing utility). **$10,650.00**

Omega Configuration 2
Hazeltine 1500 Serial terminal (80 x 24) with Mainframe of 2 x Shugart SA801R double density disk drives (480k/drive), 48k RAM, 3 x Serial RS232c ports, 2 x 8 bit parallel ports, Z80a CPU. C-ITOH 8300p printer (9" paper). Software: CP/M 1.41. **$7,500.00**

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Allows access to 100 megabytes on-line. Ideal solution for backing up hard disks for archive purposes. Transfer rate 1.1 megabaud. This interface can be used with just floppy disks for large databases. Random access capability with Video Cassettes equipped with good editing facility. Modified CP/M provided. **$1,010.00**

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- MAGSAM (Index sequential access method plus multiple key) **$320.00** (versions for Microsoft Basic and C-Basic II)
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- Vector Graphics 48k Dynamic RAM board **$700.00**
- Mostek Z80 Programming Manual **$8.00**
- Godbout I/O board (2 x RS232c serial ports) **$80.00** (no documentation available)
- Imsai SIO board 2 x RS232c Serial ports **$200.00**
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- Durst Processor model RCP 20 **$850.00**

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The world's largest, most sensitive, highest resolution radio telescope . . .

The Very Large Array

Presently under construction on a quiet, uninhabited high-altitude plateau in New Mexico, USA, this enormous Y-shaped system will provide radio astronomers with the most advanced facility ever devised.

THE VERY LARGE ARRAY (VLA) is a huge array of radio antennae situated in New Mexico some 84 km west of Socorro and 120 km south-west of Albuquerque. The telescope, scheduled for completion in 1981, will eventually consist of 27 individual dish antennae 15 m in diameter, each weighing about 214 tonnes. The 27 antennae will be spaced along the three arms of a railway track arranged in the shape of a symmetrical or equi-angular 'Y'. Two of the arms are 21 km in length and the third, the northern arm, 19 km in length. The VLA is already in a state of partial operation and more antennae are added to the system as they become available.

Design aims

The total cost of the enormous VLA receiving system has been estimated at some US$78 million (including the cost of a 28th antenna so that one antenna can be serviced whilst the others are in use). Why do radio astronomers feel that the expenditure of such an enormous sum is justified in order to listen to signals from space?

The resolution available from conventional radio telescopes is very poor when compared with optical telescopes; this means that two objects close together which emit radio waves are detected only as a single object. This problem arises because of the long wavelength of radio waves compared with light waves. In order to obtain a good radio map of the sky a telescope with a resolution far better than that provided by conventional radio telescopes is necessary. In addition, researchers are always seeking better sensitivity together with the ability to make maps or images of the radio sky within a reasonable length of time. Considerable impetus has been given to the radio astronomy programme by the realisation that a detailed study of the extra-galactic sources of radio waves is necessary for our understanding of the basic physics of the strange phenomena which occur in neutron stars and black holes.

These requirements led, in the mid-60s, to radio astronomers formulating the basic performance criteria they would like for a powerful radio telescope. This telescope would be able to provide radio images of interesting regions of the sky with the highest possible resolution and sensitivity. The main design aims may be summarised as follows:

i. A resolution of about 0.6 second of arc at an observing wavelength of 6 cm (a frequency of 5 GHz). The angular resolution obtainable is proportional to the wavelength of the received signals.
ii. Facilities to enable all of the polarization characteristics of the received radiation to be measured.

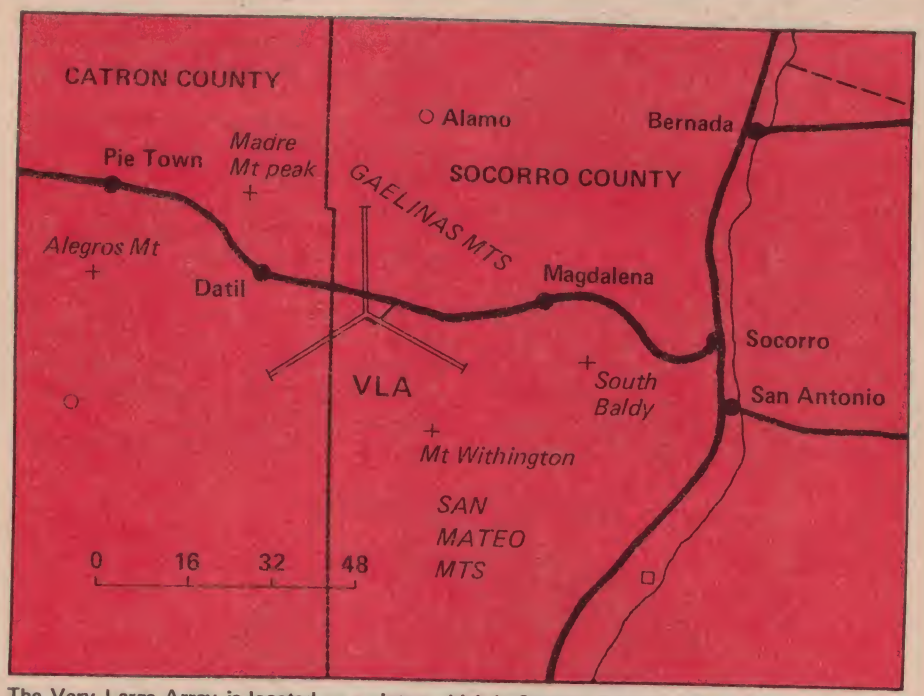
iii. The field of view of the telescope to be at least a few square minutes of arc so that a reasonable area can be mapped in a single observation.
iv. The characteristics of the received beam to be similar to those obtained using a normal paraboloidal antenna which imposes a reasonable limit on interfering signals, away from the main beam, in the side lobes.
v. The instrument is to make observations over a range of frequencies with reasonable frequency resolution to provide spectroscopic data.
vi. It was desirable that the equipment should be able to view the whole sky north of a declination of about -20°
vii. A quick change of the observed wavelength should be possible and also that simultaneous observation can be made on two wavelengths.
viii. The performance figures stated to be achieved with an observing time of not more than eight hours.

These eight criteria are some of those which most profoundly influence the design of the instrument and the possible applications, but there are other important factors. For example, the sensitivity depends on the total collecting area of the equipment and on the electronic circuitry; these factors are in turn very dependent on the funds available for investment in the equipment.

It is all very well establishing criteria for the desired performance, but it has been estimated that a conventional type of radio telescope with a fully steerable paraboloidal antenna would have to have a diameter of about 27 km in order to meet these requirements. This is clearly an engineering impossibility! Indeed, many astronomers feel that the 1000 foot (305 m) diameter Arecibo dish is the largest single antenna which it is practical to design at the present time, but this dish is fixed in position. The dimensions of a steerable antenna must be within reasonable limits or the weight of the reflector will be so great that it is deformed; in a high wind the problems are still more severe.

Arrays

The radio astronomers therefore turned their attention to multi-antenna arrays in order to obtain the required performance. A three element array is in operation at Greenbank in West Virginia, USA, a six element array at Cambridge, England and a twelve element array at Westerbork: The Netherlands. However, a far larger array was required for the VLA.



The Very Large Array is located on a plateau, high in Socorro County in New Mexico, USA. The North arm straddles highway 60 which was straightened to accommodate the location of the VLA. The installation is to be run by the National Radio Observatory of Associated Universities Inc, under contract with the US National Science Foundation.

Radio antenna arrays can employ the technique of 'aperture synthesis', developed about 1960 by Martin Ryle, Director of the Mullard Radio Observatory in Cambridge (which helped him to gain a Nobel prize in Physics jointly with Anthony Hewish). When all 27 antennae are available in the VLA, there will be 351 separate pairs of elements which act as 351 individual interferometers. (One can choose two things from 27 in 351 different ways, since:

$$_{127}C_{2} = 127!/125!2! = 351).$$

As the earth rotates, the individual antennae of the array track the source of radio waves under observation. Up to a few million independent measurements can thus be obtained as the source traverses the sky and these can be combined in a computer to produce the required radio map.

The VLA

The Y-shaped pattern was adopted for the VLA after computer simulation work had shown that this pattern would give the best possible performance of the many possible system arrangements.

Proposals for the VLA originated in the period 1964 to 1971 and great care had to be given to the choice of a suitable site. A large, flat area was required, sparsely populated and little used, in a region of low radio noise. A site at a low latitude was sought so that a large part of the sky could be viewed as the earth rotates. This site had to be on an elevated plateau so that the atmospheric effects on the incoming signals were minimised. In addition, the climate at the site should be relatively dry to minimise the effects of water vapour in the air on the signals.

A thorough search was made in the south-west region of the USA, but very few sites were found which met the requirements. Fortunately, the site selected in the Plains of San Augustin meets the requirements almost perfectly. It is a large area ringed by mountains (which offer useful shielding against unwanted radio signals) and is a rather beautiful region some 2130 metres above sea level. There are no towns or villages on the selected plain, cattle ranching being the only occupation. Although the cattle ranchers were at first worried about the new project, they soon accepted it and now realise that it it only a receiving station. Cattle can continue to graze peacefully near the giant antennae. ▶

The antennae

The antennae are being constructed by E-Systems Inc. of Dallas, Texas. The first antenna was accepted on September 22nd, 1975 and received its first signals from Virgo A (3C-274) on October 24th, 1975 in the 5 GHz band. A second antenna was accepted on November 13th, 1975 and by February 18th, 1976 both antennae were under computer control using a 1.24 km interferometer baseline in the same frequency band.

Each antenna is a massive structure some 28.7 m in height, assembled at a central facility and moved out on a railway track to one of the 72 observing points of the VLA. Each arm of the Y-shaped array is equipped with a double railway track called the 'the rail to nowhere'. Short spur tracks lie perpendicular to the main tracks at each of the observing points so that an antenna can rest on any of these spur tracks. All transportation along the arms of the Y is by rail, no roads being provided.

When a change of focus is required, the huge antennae are lifted from their pillars and moved by means of three 24-wheel transporters along the railway track. Four basic configurations are employed with lengths of 21 km, 6.4 km, 1.9 km and 0.6 km. The configuration chosen depends on whether one requires maximum resolution using the 21 km baseline or a greater sensitivity combined with a reduced side-lobe pattern.

Each of the antennae transporters weighs about 66 tonnes and can travel at speeds of up to about 8 km per hour. Antenna can be transferred from one arm of the Y array to another arm if they are first moved to the centre of the array where the tracks meet. Thus, major changes in the antenna configuration can be made in about a day. Each of the 72 observing points contains all of the equipment required for anchoring the antennae and provides electric power and all of the required signal communications connections.

Each antenna is designed to operate in a wind of up to 64 km/hr and to withstand a wind of up to 177 km/hr even if coated with 109 kg/m^2 of ice. The receiving system permits operation in any one of the four frequency bands 1.35-1.73 GHz, 4.5-5.0 GHz, 14.4-15.4 GHz and 22-24 GHz. In order to obtain a high performance at high frequencies, the reflector surface of each antenna must maintain its shape to within ±0.75 mm even when a wind of up to 64 km/hr is present. At low frequencies the shape of the reflector is far less critical than at the maximum design frequency of 24 GHz (1.25 cm wavelength).

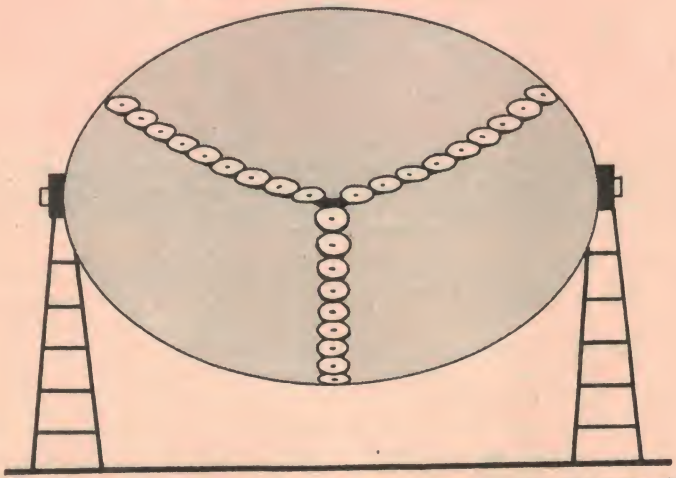
It is essential that each antenna of the VLA can be accurately pointed at the required region of the sky. The pointing and tracking accuracy is under computer control and is better than ±15 seconds of arc. Alarm buttons are placed at various points on each of the huge dishes so that if the dish begins to move when a person is on it, he can signal to the operator that he is there.

The antennae operate as Cassegrainian systems in which signals from the primary or main reflector strike a secondary reflector which reflects them into the feeders in the centre of the main dish; they then pass into the receivers below the antenna. The feeders for the different frequencies are arranged in a circle around the axis of the main reflector so that, as the secondary reflector is rotated, the signals are directed to the desired feeder. The rotation of the secondary reflector is controlled by the main computer of the VLA, so it is easy for astronomers to change the frequency of the receiver system. This offset secondary reflector and multi-frequency feed system is based on spacecraft tracking antennae.

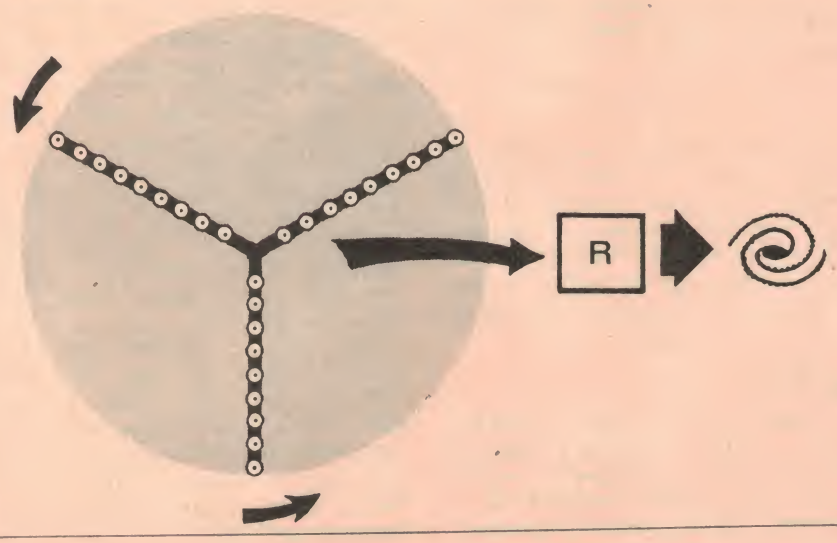
The receivers

Two completely separate receivers are used for each frequency band at each of the antennae so that complete measurement of the polarisation of the incoming signals can be made at any one

HOW THE VLA WORKS



Many small antennas arranged in a 'Y' configuration can simulate the large, single dish telescope (as illustrated diagrammatically above) by utilizing the Earth's rotation. When the 'Y' system is rotated relative to the object being observed, in 8-12 hours "exposure time" the large telescope array will generate a high resolution 'picture' of the radio source it is set to track.



wavelength or (with the aid of additional radio mirrors and lenses) the simultaneous measurement at two frequencies in one plane of polarisation.

Each VLA front end accepts signals in any one of the four frequency bands, converts them to the 4.5-5 GHz band if they are not already in this band, amplifies them and passes them on to a central computer facility. The front end should introduce a minimum amount of noise and therefore the complete units are cooled to 18 K (-255°C) using a refrigerator system; the latter consists of a two stage closed-cycle helium refrigerator with a 10 W capacity second stage which keeps the temperature constant to 1 K.

Each front end uses a cooled parametric amplifier operating in the 4.5-5 GHz band (which is the optimum frequency for cooled parametric amplifiers). A solenoid operated coaxial switch allows a straight through connection to the amplifier input for signals in the 5 GHz band and connection to one of the converters for other input frequencies. A parametric up-converter is used for the 1.35-1.73 GHz band and two cooled Schottky diode mixers for the higher frequency bands.

The parametric amplifiers are two-stage 25 dB gain units which are followed by a gallium arsenide FET amplifier operating at room temperature. The receiver noise temperature in the four bands in order of increasing frequency is 18 K, 25 K, 200 K and 240 K, while the total system temperature is 47 K, 49 K, 240 K and 290 K.

The received signals are conveyed to the central computer room by lengths of circular waveguide placed along the three arms of the Y-shaped VLA. This 60 mm diameter waveguide, which is buried in the ground, also carries all signals between the antennas and the computers. Control and command signals to direct the antennae as well as local oscillator signals are sent along these waveguides. This type of waveguide was developed to handle 600 000 simultaneous telephone calls. A single length of continuous waveguide is used in each arm of the Y and conveys all signals to and from as many as 12 antennae in the one arm.

The rather remarkable waveguide system allows a greater degree of flexibility in the VLA than possible using other techniques. For example, ordinary radio communication would not be acceptable because it could cause interference with the VLA. The maximum communication path length of 21 km is achieved without the need

A special transporter vehicle was constructed to carry the huge antenna assemblies to their sites once their construction was completed. Above is antenna No.1 on the transporter, July '75.

A closer view of the specially-built transporter, taken while it was moving antenna No. 1.

An unfinished antenna in the antenna assembly building – also specially built for the construction of the antenna assemblies. Some idea of the size can be gauged from the small figures visible at the base of the antenna, adjacent to the transporter (right). ▶

for any repeaters; the attenuation of a 50 GHz signal is only 1.4 dB per km. Each antenna in an arm of the Y is allocated a 1 GHz bandwidth channel and 11 channels (two spare) spaced 2.4 GHz apart are allocated in the 27 GHz to 53 GHz range.

Signal processing

The output of the 27 receivers of the VLA system will be combined and fed through digital filters in real time. Although the signals are usually weaker than the noise level, the common signals are selected by comparing every antenna output with every other for 351 pairs of outputs and by multiplying each against the points to be measured. This is equivalent to some 11 654 multiplications at a data rate of 100 MHz.

Discrete component systems would be too bulky and too slow for this purpose and would run hot, so it was decided to employ fast emitter coupled logic (ECL). Suitable devices were not available on the commercial market so an independent manufacturer of custom built ICs (Silicon Systems Inc.) was approached with a request that they design suitable devices. The resulting chips can operate at a 300 MHz clock rate with static inputs or 200 MHz with dynamic inputs; this is considerably greater than the VLA requirement.

The 90 x 93 mil ECL chips are used with three tiers of logic for 100 MHz operation; the stacking of current switches in three layers reduces the propagation delay time. They take the 100 MHz three-level digital coded signals from the analogue-to-digital converters and produce data in 4 MHz serial form for the central computer to analyse. The 6 500 ECL chips are basically digital multipliers which filter the common signal from the 27 antenna signals. The design of the circuit includes four flip-flops, 8-input buffers and two ECL-to-TTL converters.

Low power Schottky TTL is adequate in speed for the somewhat slower integrator and a 423 transistor device (78 x 93 mils) was developed for use as a counter and shift register. There are 13 500 of these TTL integrator chips used for combining the correlated outputs for 4 MHz transmission to the main computer frame.

The use of integrated circuits has resulted in increased reliability because of the smaller number of interconnections than if discrete devices had been used. In addition, a cost saving of US$100 000 is said to have been achieved through the use of the purpose built devices. At least three other observatories are now using Silicon Systems devices.

Computers

The processed outputs are fed into a computer system, since only a computer can handle the very high incoming data rate. A 'Boss' computer controls the 'Cora' computer which collects the incoming information and also a 'Corbin' computer which has the difficult task of correlating this information. The fourth computer, known as 'Monty', monitors the performance of all four computers including itself.

The output from the computers is a roll of paper on which is printed many numbers, each representing the signal strength in a region of a few seconds of arc. Computers are ideal for calculating such signal strengths, recording the time of day at which they occurred and all equipment parameters, especially as the signal itself is no more interesting than the radio noise one hears when a VHF receiver is tuned between two stations without inter-station noise muting!

Performance

The sensitivity of the VLA is sufficient to detect signals which have a power of only 10^{-27} W/m^2/Hz at the surface of the earth, but it is difficult to comprehend the meaning of this power level. If the bandwidth is 100 MHz, it corresponds to 10^{-19} W/m^2 or 10^{-23} W/cm^2. Expressed in another way, one can say that the VLA will be able to detect, with a signal-to-noise ratio of about five dB, a signal which is one ten-thousandth of the intensity of the signal detected by Karl G. Jansky in 1932 – the first extra-terrestrial radio source detected by man. The high sensitivity is partly due to the large total collecting area of the 27 antennae of 25 m diameter which is almost equal to that of a single telescope of 130 m diameter. The sensitivity is better by a factor of ten than any other telescope yet made.

However, the improvement in resolution offered by the VLA is even more impressive. Until fairly recently the resolution of a radio telescope could not even match that of the unaided human eye for visible light; the eye can separate two points of light about 180 seconds of arc apart. The resolution of the Mount Palomar optical telescope is about 8000 times better than that of the human eye, namely about 0.0225 second of arc. Thus one can see fine detail with this telescope. The best resolution expected from the VLA is about 0.13 second of arc or about 5.8 times worse than that of the Mount Palomar telescope. This relatively high resolution at radio frequencies is what really excites astronomers about the VLA.

The resolution of an optical telescope is approximately proportional to the wavelength of the light divided by the diameter of the collecting mirror (the smaller the resolution, the better the telescope performance). The large mirror of the 200 inch (5.08 m) diameter Mount Palomar telescope thus provides a much better resolution than the human eye; both function at optical wavelengths.

Radio waves of a frequency of a few GHz (similar to those received by the VLA) have a wavelength about 100 000 times greater than optical wavelengths. Thus, in order to obtain a resolution for radio sources similar to that provided by the Palomar optical telescope, one might expect one would have to construct a radio telescope with a diameter of some 508 km! At some frequencies this requirement can be reduced by a factor of about five times, but it is nevertheless impossible to construct a reflector of any diameter approaching this. Therefore the VLA employs a number of dishes spaced out over a large area with their signals suitably combined to provide a resolution which, although not equal to the optical resolution of the Mount Palomar telescope, is able to approach the resolution of this optical instrument.

The resolution obtainable from the VLA depends on both the wavelength of the received signals and on the particular array configuration employed. For example, at 5 GHz the four basic antenna configurations provide resolutions of 16, 5.4, 1.8 and 0.6 seconds of arc, the best value of 0.6 seconds of arc being obtained with the 21 km configuration. At frequencies of about 23 GHz the radio wavelengths are smaller and a correspondingly better resolution of about 1.3 second of arc can be obtained.

Apart from its performance, a great advantage of the VLA is its flexibility and wide frequency range. It can cover both the hydrogen and hydroxyl lines in the single frequency band of 1.35 to 1.73 GHz. Spurious effects due to antenna side lobes and atmospheric fluctuations are less than 3%. The

observer can choose from quite a variety of antenna and electronic system configurations. Maps of a region about 0.5° square can be obtained in eight hours with an angular resolution of about 1 minute of arc and a frequency resolution of a few KHz over a wide bandwidth.

Applications

The availability of the VLA facilities is expected to make a great impact on almost every aspect of astronomy. We can therefore only mention a few examples of its likely use.

One of the first applications of the partially completed VLA system was for mapping planetary nebula which are shells of hot gas ejected from dying stars. A resolution of about 1.5 seconds of arc, similar to that of excellent optical photographs, was obtained at a wavelength of 6 cm, using the seven antennae available at the time with a maximum separation of 5.2 km. Planetary nebulae were chosen for this preliminary work, since they are compact objects with a high surface radio brightness. The four nebulae examined had previously been mapped at radio frequencies with somewhat inferior resolution in most cases, so the quality of the VLA resolution could be assessed. These nebula also form a useful test, since their radio and optical emissions come from the same hot, ionised gas.

The VLA is also likely to be used to investigate the centre of our galaxy. This cannot be examined by optical instruments, since thick clouds prevent visible light from reaching us from this region of Saggitarius. Radio astronomy has shown that a radio source exists near the centre of the galaxy which is exhibiting a rapid outflow of gaseous material, but further investigation is needed.

Radio astronomers also use the VLA to search for interstellar molecules which emit radio waves. Many types of molecule have already been discovered, but the VLA will be used to look for evidence of various organic molecules which are present in the distant clouds of gas and dust on the edges of the Milky Way which some people believe are the breeding grounds for stars and planets. The presence of such molecules may indicate that planets may be formed already stocked with the molecules required for life.

One of the most interesting applications of the VLA is for the study of the most distant parts of the universe. Signals from such regions are very weak owing to their extreme distance, so a huge telescope such as the VLA is needed to provide good data. Such work may answer questions such as: "Is our universe in a state of continual expansion or will it contract again so as to form a point discontinuity and hence generate another 'big bang'?".

There is also a great deal of work to be done on such topics as quasars, pulsars and the little-known black holes which are all strong radio emitters. In such objects conditions exist which cannot be duplicated on earth, so a study of them may greatly advance our understanding of the physical world.

Acknowledgements

The VLA is being constructed by the US National Radio Astronomy Observatory (NRAO) for Associated Universities Inc. under contract to the National Science Foundation of the USA. It provides facilities for scientists from US universities and, when fully operational, will have a support staff of about 100 people.

The author is indebted to Mr. John H. Lancaster, Manager of the VLA Programme, of the NRAO for the detailed information and photographs which he kindly provided for this article. ●

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New approach to electronics education

Roberta Kennedy

OUR RECENT survey of electronics courses and careers (ETI January and February 1980) pointed to a number of anomalies within the existing education system. The most obvious of these was the apparent structuring of courses at technical colleges, TAFEs and the like to fill the arbitary job classifications laid down by the Public Service and other government bodies.

While it is true that, until recently, such government departments were the major employers of electronics personnel, this situation is changing. There is an increasing demand from private industry for trained servicemen, technicians and other electronics staff, and as this demand grows it is becoming clear that government-structured courses are just not providing enough suitable trainees for these industries.

The problem with many TAFE courses is that they are relatively long (two years or more), have high entrance requirements (especially in mathematics), contain a low percentage of 'hands-on' workshop training, and are broadly based rather than aimed at filling specific job vacancies. As a result, these courses cannot possibly turn out enough trainees to keep up with current industry requirements, and many students who complete these courses are lacking the practical experience necessary to move directly into full-time workshop positions without further company training.

This situation is unlikely to change, despite repeated requests from the private sector to the Department of Education for a general re-structuring and updating of current courses, and for the creation of special courses to train people for jobs in their organisations.

What the private sector needs *now* (and will need even more in the future) are trainees with 'hands-on' practical experience to work as servicemen and technicians. They are also looking at the idea of employing people with a basic background in electronics for management positions, in the belief that such people will be better equipped to deal with future trends in the industry. Those companies involved in marketing electronics products are also seeking sales personnel with an understanding of electronics, in order to better promote their products.

The official policy of technical colleges is that they cannot be geared to specific industry needs. The potential for a private electronics course designed to meet industry requirements is therefore enormous, and this is where the School of Electronics fits in.

Situated at Milsons Point, Sydney, the School was founded three years ago by John Burnett, with the initial aim of establishing a full-time electronics course for school leavers. The first course actually implemented by the School was, however, their Audio Engineering Programme, which has proved most successful (see February ETI, page 37). The School is now in the process of expanding – taking over the ground floor (in addition to their 3rd floor premises) to accommodate a complete electronics workshop, which will be the training ground for the electronics courses starting this month.

The course

John Burnett has spent two years researching the course; talking to employers, technicians, servicemen, and many companies involved with electronics. By finding out exactly what skills are in demand, and the type of training needed to provide them, he has formulated a course specifically aimed at preparing students for employment on completion.

The full-time programme is held over 24 weeks (six hours a day, four days a week). A maximum of 60 students will be enrolled, and these will be split into four groups of 15 students for class work.

The course is designed for school leavers (and others with *no* knowledge of electricity or electronics) who wish to train for careers in the electronics service industries. There are no prerequisites, and no age restrictions.

The basis of the course is 50% practical workshop training and 50% related theory – i.e.: instead of practical sessions being used for the illustration of a theoretical principle, they are regarded as the most important part of the course, with theory providing a back-up explanation.

Construction, design and servicing (with the emphasis on the latter) are the basic skills covered. Students will be trained in the servicing of the majority of consumer electronic products now on the market – radio and television sets, tape recorders and cassettes, stereo equipment, household appliances, electronic games etc. Other studies include auto-electrical maintenance and repair, business equipment (typewriters, word processors, calculators, photo-copiers etc.) digital, analog and audio circuit design, and the construction of transformers, power supplies and printed circuit boards. A knowledge of components, suppliers and manufacturers is also included. The course will be up-dated yearly, to make sure it keeps pace with industry trends.

The School is working in close co-operation with companies who manufacture, import and market electronic products, and it is intended that these companies will employ large numbers of their students. Already there have been many enquiries from such companies, asking when the first group of trainees will be available!

Services

A number of services for private companies are available through the School. For example, a company dealing with electronic/electrical products can arrange with the School for students to do maintenance work and service on their product lines, either in the company's workshop or at the School. This arrangement provides a wide range of equipment for students to work with, an experience of real work situations, an introduction to potential future employers, and some idea of what these companies would be like to work for. Thus the 24 week course can be regarded as real work experience.

John Burnett

Special courses can also be arranged for companies who require specific training programmes for their employees, or for businesses who want staff to be retrained.

In conjunction with the full-time course, the School is also introducing a part-time electronics course, designed for people whose work involves electronics and who need to update their knowledge, and for others (such as hobbyists) with a basic understanding of electronics, who want to broaden their skills.

Entrance requirements for the part-time course are a basic understanding of electrical principles, mental maturity and aptitude (defined by John Burnett as "the ability to pull something apart and see how it works"). There is no restriction on age, although the School expects this course will mainly attract people in the 25-35 age group.

Content of the course is similar to the full-time programme 50% practical, 50% theory, (with the emphasis on hands-on training), but it starts at a higher level and is more intensive. Classes will be held one night a week over 30 weeks, with a maximum of 15 students per class.

There are currently three full-time (and several part-time) teachers attached to the School, who are involved in all courses, including the audio programme. These are John Burnett himself, whose background is in audio engineering and the manufacture of audio and electronic equipment, Rod Elliott, who has previously been involved in research and design of electronics, and Steven Penning, an industrial electronics engineer and recording engineer, who has been with the School from the beginning. More full-time staff will be recruited as the School expands.

Fees are calculated on the basis of $20 per lesson, which adds up to $1200 for the full-time course and $600 for the part-time course. It is a policy of the School that students do not sign a contract and can pay their fees in monthly instalments, tuition being terminated by non-payment of fees. This ensures the integrity of the School, and avoids the problem of students losing interest in the course and thus losing money. John Burnett believes that this is the reason why there have (so far) been no drop-outs from the School. If a student has to discontinue a course for any reason, they can pick it up again the following term.

As private schools cannot grant diplomas, students are instead given a certificate of proficiency and an individual assessment (similar to a reference) on completion of their course. Assessment is based on aptitude, attendance and assignments set throughout the course.

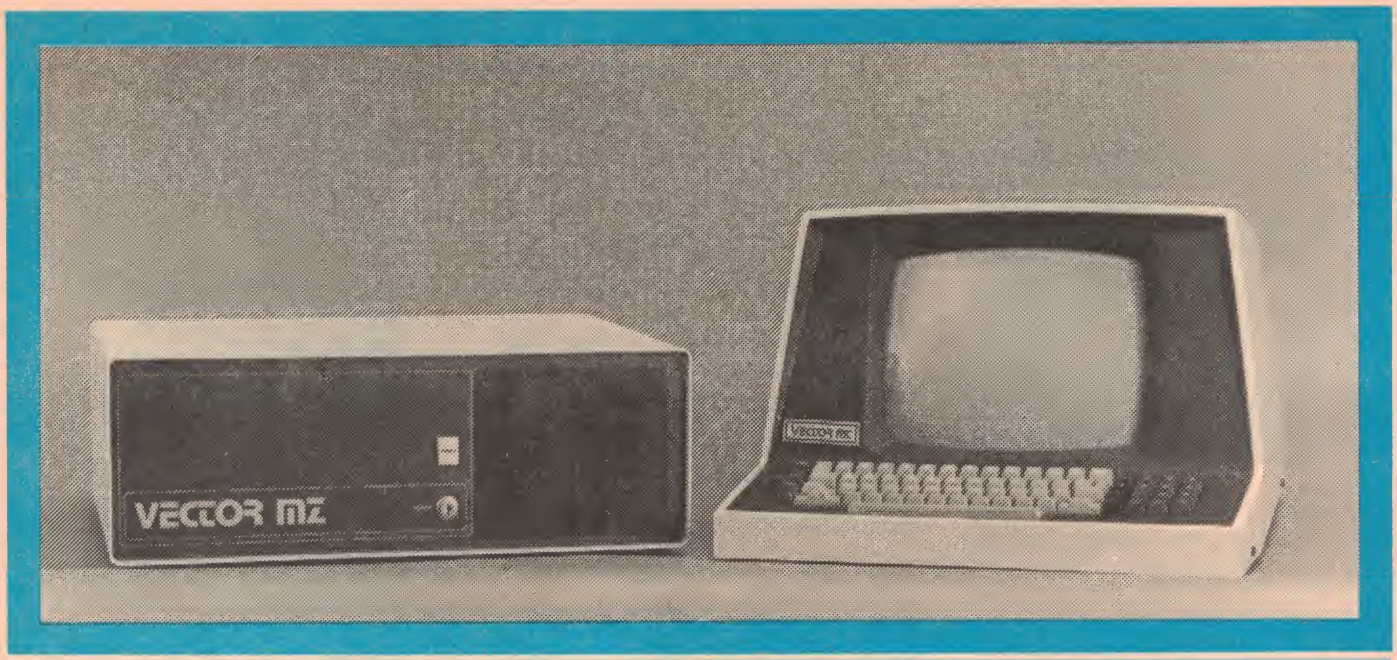
The future

John is pushing to have the full-time course recognised under the NEAT (National Employment and Training) Programme, whereby government assistance is given to unemployed people who require training to increase their employment prospects. Courses must be approved by the Department, such approval depending on the current labour market. It is also hoped that the course will be accepted as a prerequisite for more advanced electronics courses, such as the E & C certificate.

To this end, John has spent a lot of time talking to careers advisers in high schools, the Department of Youth and Community Services, technical colleges and the like. He is ensuring that they are aware of the course, and hoping that they will eventually refer suitable students to the School.

Careers Advisory Services receive many enquiries from the electronics industry, and are fully aware of the enormous demand for employment in this area. While they agree with John Burnett that electronics must eventually be included in the high school curriculum, they are not in a position to influence the Education Department to this end, and there are at present no plans to introduce electronics to high schools. Thus, despite the pressing need for more trained electronics personnel, and the vast unemployment in other areas, high school students are generally unaware of the career possibilities in this industry.

As government departments are not noted for the speed with which they implement changes, it will obviously be a long time before the situation with respect to electronics education will be rectified. Meanwhile the jobs are there, waiting to be filled, and the School of Electronics is making sure that at least some of them will be. ●



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Simple, sensitive Geiger counter

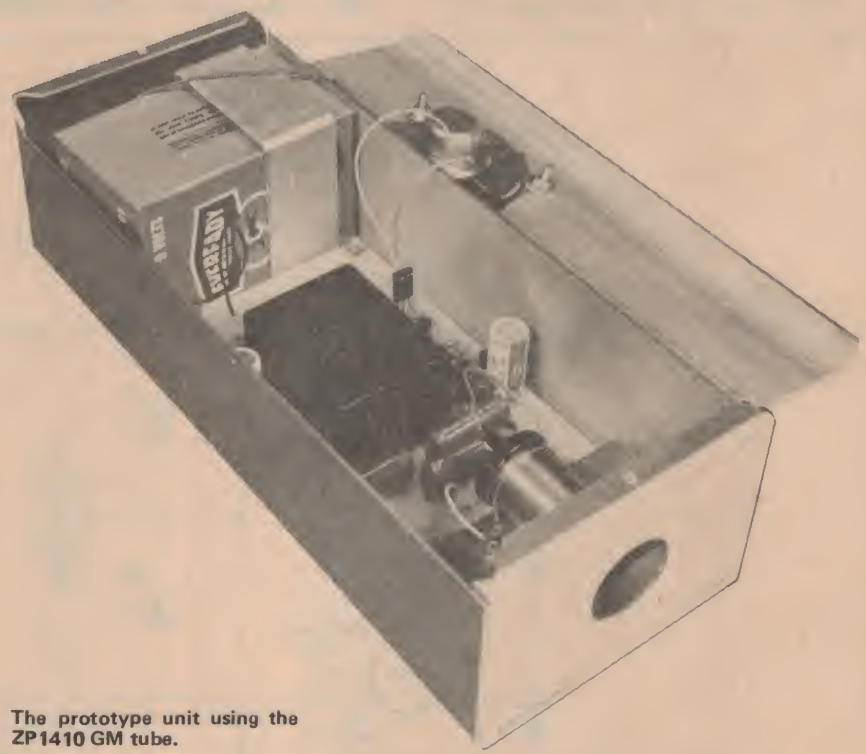
Radioactivity is a fascinating subject. The more you learn about it, the more questions there are to ask! This project is simple to construct and relatively inexpensive. It should prove of great interest to science teachers, students and anyone generally interested in radioactivity.

David Tilbrook

IN 1896, Henri Becquerel announced the discovery of radioactivity. He had been experimenting with the element uranium and found that it spontaneously emitted energy, without activation by another energy source. Immediately, researchers started the quest for other elements that might also exhibit this property of natural radioactivity. Pierre and Marie Curie isolated two new elements from a uranium ore called pitchblende. Naming these elements polonium and radium they discovered their new elements were enormously radioactive. Polonium for example, is approximately 10 billion times more active than an equivalent mass of uranium.

The radiation emitted by radioactive elements was at first likened to X-rays, discovered only four months earlier, but it was Ernest Rutherford who first found that there was more than one kind of radiation. The most obvious difference was the ability of the radiation to penetrate matter and he called the least penetrating radiation α (alpha) rays, and the other more penetrating radiation β (beta) rays. Magnetic field deflection of the rays showed that β rays were in fact free electrons. Further work carried out by Rutherford on the α ray showed that it consisted of particles also and had a positive charge equal to the charge of two protons. The particle of the α ray was later proved to be the nucleus of the element helium, consisting of two protons and two neutrons bonded together. The poor penetrating ability of the particle is thought to be due to its positive charge and the repulsive force it will experience if it approaches the nucleus of an atom.

In 1900 a third kind of radiation was discovered. Called 'gamma' (γ) radiation, it was found to have tremendous penetrating power because of its neutral charge. Gamma particles turned out to be electromagnetic radiation, the same as light, but with much higher energy.



The prototype unit using the ZP1410 GM tube.

Measuring radioactivity

With the development of the understanding of radioactivity it was necessary to invent detectors which would enable the radiations to be recognised and measured. The most sophisticated of these is the *bubble chamber*. A development of earlier cloud chambers, these devices enable the tracks of nuclear particles to be studied, the particles themselves being recognised by the characteristic 'tracks' they make in the chambers.

Just as important are the simpler radiation detectors, the *scintillation counter* and the *geiger counter*. These enable the presence of radiation to be recognised and measured quickly and conveniently.

Scintillation counters use a crystal that fluoresces when a particle travels through it. This crystal is mounted on top of a sensitive photomultiplier, which will detect any generation of a light pulse in the crystal. Scintillation tubes however are expensive and require a complicated power supply and amplifier, making them unsuitable for home construction. The geiger counter, on the other hand, is simple to construct and inexpensive.

Geiger counter

Since this project is designed as a general purpose geiger counter I have made it compatible with two GM tubes. These are manufactured by Philips and are designated ZP1310 and ZP1410. The ZP1410 is an end window α, β and γ sensitive tube and is therefore more expensive than the ZP1310. It is also more fragile and the end window should not be touched. The ZP1310 having no end window will only detect particles with sufficient energy to penetrate the tube, such as higher ▶

HOW IT WORKS – ETI 562

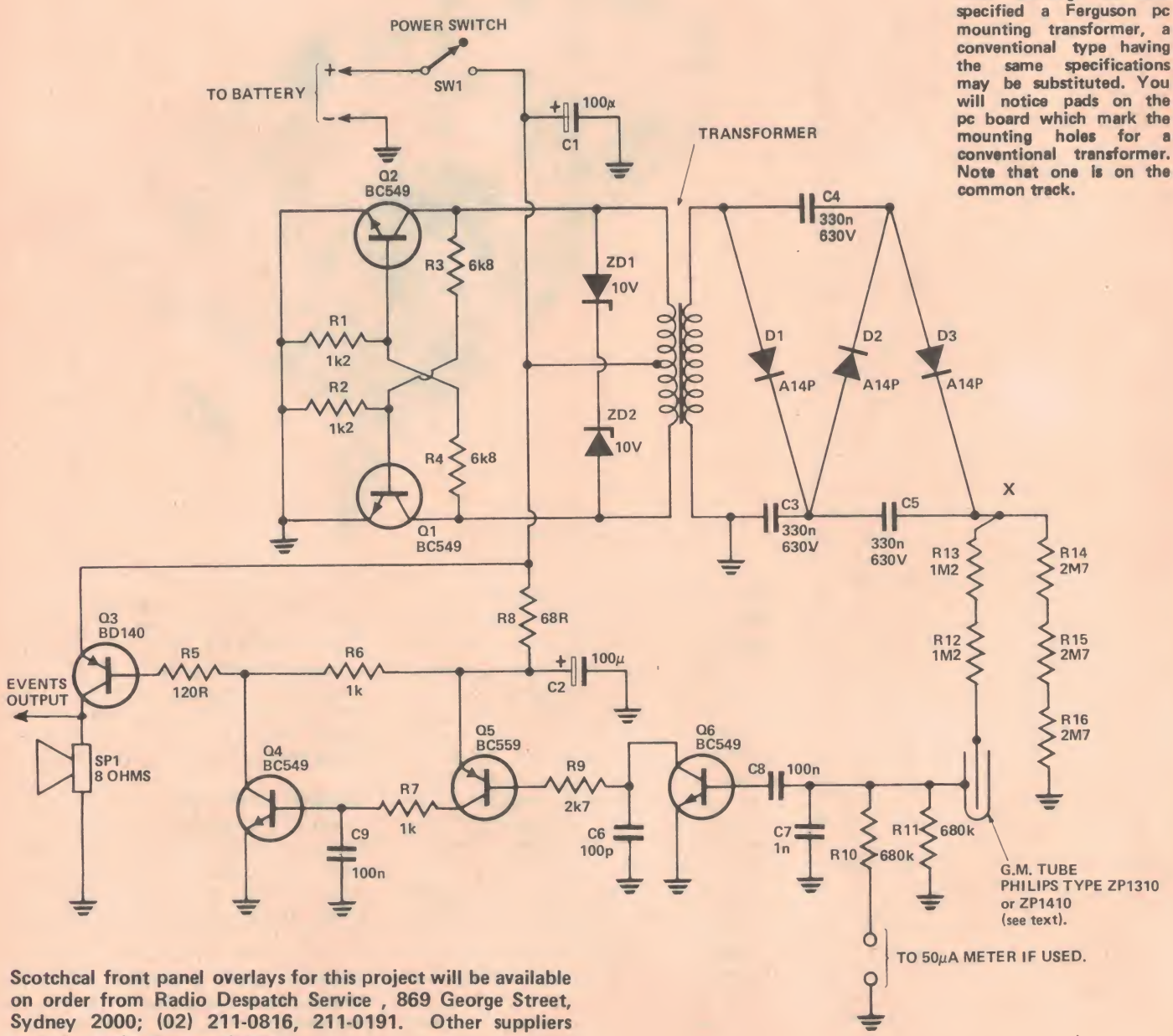
The geiger tubes specified for this project have plateau regions around 600 V. To obtain this voltage from a six or nine volt battery the circuit uses an astable multivibrator, formed by Q1 and Q2, driving the 12 volt side of a Ferguson pc board mounting power transformer. This is normally the secondary side of the transformer but in this circuit it is used as the primary. Zener diodes ZD1 and ZD2 limit the voltage that can be applied to the primary of the transformer to around 10.5 volts, and this gives approximately 200 volts on the secondary. Diodes D1, D2 and D3, and capacitors C3, C4 and C5 form a voltage tripler that produces 600 V at the point marked X on the circuit diagram.

This voltage is applied to the anode of the GM tube via two 1M2 resistors R12 and R13. Most common ½W resistors have maximum voltage ratings around 270 volts, so it is necessary to use the series combination of R12 and R13 to provide the series anode resistance for the tube, rather than use a single 2M2 resistor. Resistors R14, R15 and R16 discharge the supply after turn-off and help to stabilise the anode voltage by providing a slight current drain on the tripler at all times.

When a particle enters the tube, ionisations take place and a current pulse flows through the tube via R11 to ground. This pulse causes a momentary voltage rise across R11. When this voltage gets to 0.6 volts the base emitter of Q6 is turned on, causing Q5 to conduct momentarily. This provides a pulse onto the base of Q4, driving Q3 to produce a pulse in the loudspeaker.

The capacitors C2, C6, C7 and C9 provide filtering, primarily to remove any injection from the multivibrator.

Note: although we have specified a Ferguson pc mounting transformer, a conventional type having the same specifications may be substituted. You will notice pads on the pc board which mark the mounting holes for a conventional transformer. Note that one is on the common track.



Scotchcal front panel overlays for this project will be available on order from Radio Despatch Service , 869 George Street, Sydney 2000; (02) 211-0816, 211-0191. Other suppliers may also make them available.

The pc board patterns are on page 113.

energy β particles and γ particles. Fortunately most radioactive elements emit all three radiations so the ZP1310 is entirely adequate for most purposes.

Construction

The construction is reasonably simple, since it is mostly confined to the printed circuit board. Start by mounting the resistors and capacitors on the pc board. Then mount the transistors, diodes and power transformer. Be sure the transistors, diodes and electrolytic capacitors are connected the correct way around. The pc board has provision to drive a 50 uA meter movement although I did not use this facility when building the prototype. The biggest problem is one of calibration. The meter is useless unless one has access to a calibrated reference instrument. For most purposes it is sufficient to use the click rate as an indication as to how radioactive a sample is.

If the ZP1310 tube is used it is mounted directly onto the pc board. Do not solder directly to the anode of the tube. The tube should be supplied with an anode connector. Solder this onto the pc board first and then plug the tube into it. If the tube is not supplied with an anode connector remove one of the socket pins from a 9-pin valve socket and use this instead. Once the anode is connected the cathode strap supplied with the tube can be soldered to the pc board. Do not solder directly to the GM tube to make the cathode connection. If you are using the ZP1410 tube, this must be mounted so that it is insulated from the case and connecting wires taken back to the pc board. I used a piece of pc board that is mounted on insulated 25 mm spacers. The tube is fixed to the board using two wire loops, around the tube and through holes drilled in the board. The cathode connection to the tube is made by soldering the cathode strap onto the small pc board. As with the ZP1310 do not solder directly to the anode of the tube. Use an anode connector if it is supplied or a socket pin from a 9-pin valve socket.

Once the board is completed it can be mounted in a suitable chassis. I used ▶

PARTS LIST - ETI 562

Resistors ..... all ½W, 5%

R1	1k2
R2	1k2
R3	6k8
R4	6k8
R5	120R
R6	1k
R7	1k
R8	68R
R9	2k7
R10	680k
R11	680k
R12	1M2
R13	1M2
R14	2M7
R15	2M7
R16	2M7

Capacitors

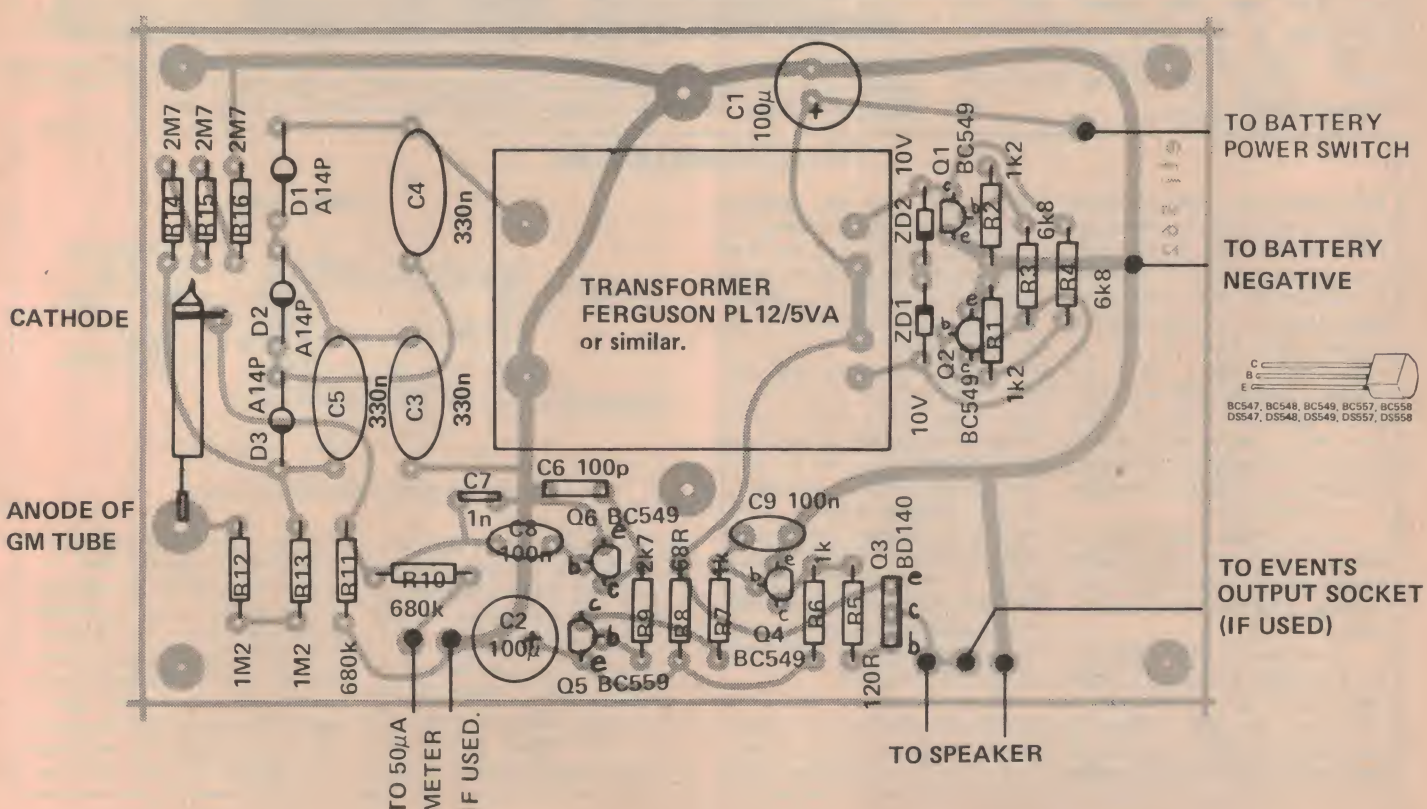
C1	100u 25V electrolytic
C2	100u 25V electrolytic
C3	330n 630V greencap
C4	330n 630V greencap
C5	330n 630V greencap
C6	100p disc ceramic
C7	1n greencap
C8	100n greencap
C9	100n greencap

Semiconductors

Q1	BC549
Q2	BC549
Q3	BD140
Q4	BC549
Q5	BC559
Q6	BC549
D1, D2, D3	A14P or similar 1000V piv diode
ZD1, ZD2	10V 400mW Zenner diode

Miscellaneous

1 x pc board ETI562; 1 x Ferguson pc mounting power transformer; 1 x ZP1310 or ZP1410 geiger tube (see text); 1 x Horwood aluminium chassis, type 34/10/DS; 1 x battery - Eveready 276-P or equiv.; 1 x on/off switch, spst; 1 x chassis mounting RCA socket; assorted nuts. bolts, washers etc.



a Horwood type 34/10/DS, in which everything fits quite nicely. The circuit operates from six to nine volts and the battery used in the prototype was an Eveready type 276-P. This is a nine volt battery and is best mounted using a bracket of bent-up aluminium. The circuit pulls around 50 mA, so whatever battery you choose make sure it is capable of delivering this amount of current.

Powering up

Before applying power to the circuit check the pc board layout. Make sure that all polarised components have been mounted on the pc board correctly. Make a special check of the two 10 V zener diodes. These regulate the voltage that is applied to the tube so it is important that they are inserted correctly. If all is well connect the battery and measure the voltage at point X on the pc board. This is the output of the voltage multiplier and the voltage at this point should be between 550 V and 650 V.

The moment the unit is turned on it will start to detect background radiation. The unit will 'click' once every couple of seconds. This background radiation is caused mainly by cosmic radiation.

Some older watches used small amounts of radioactive isotopes to activate the luminous dial. Even if the dial has long since lost its luminosity it will still be radioactive. If this watch dial is brought near the geiger counter the count rate will increase significantly. ●

Overall view of the pc board of one unit constructed using the lower cost beta/gamma GM tube, ZP1310. Be careful with the anode and cathode connections, as explained in the text.

The alpha/beta/gamma-sensitive GM tube is an end-window type and requires a different mounting method. I secured the ZP1410 to a small piece of pc board, as described in the text, mounted in the end of the case. The tube's window must be aligned with the hole in the case end.

THE GEIGER MULLER TUBE

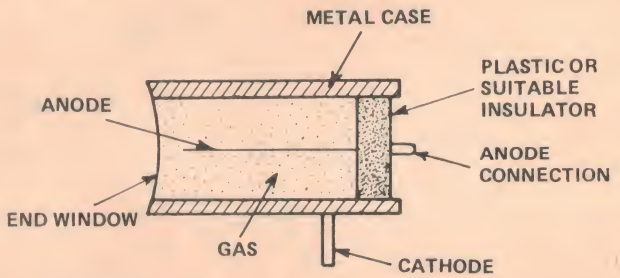
This consists of a metal tube or cylinder, hermetically sealed and filled with a gas at less than atmospheric pressure. If the tube is intended for the detection of alpha particles (as well as beta and gamma radiations), it will be constructed with an 'end window', as illustrated here. Since alpha particles have so little penetrating ability the window must be extremely thin. Thus, the windows are difficult to manufacture and are *fragile*.

Geiger tubes constructed to detect only beta and gamma radiations do not have an end window, otherwise construction is similar.

In the centre of the tube is a wire ANODE. The metal cylinder itself serves as a CATHODE. In operation, a high voltage is connected between the anode and the cathode, anode being positive with respect to the cathode.

As the voltage between the electrodes is increased, the tube goes through three phases: if the voltage is lower than a particular value, the gas in the tube will not be ionised and no current will flow. Above this particular voltage (the 'striking' voltage), the gas ionises and a small current flows continuously through the tube. This is the phase in which the tube is operated – referred to as the "plateau region". If the voltage is increased even further still the tube will enter the third phase – that of arc discharge between the anode and cathode. If the tube is allowed to operate in these conditions it will almost certainly be damaged.

When a particle enters the tube operating in its plateau region, it ionises the gas further and the ions produced are accelerated towards the cathode, electrons towards the anode. These moving ions cause further ionisations and an avalanche of ions (and electrons) occurs.



A TYPICAL END WINDOW G.M. TUBE

When the tube is operated in its plateau region a single particle of radiation will cause an avalanche of millions of ions and electrons. Each avalanche is registered as a momentary increase in the current through the tube. This current pulse can be detected as a voltage pulse across a resistor connected in series with the tube. If the voltage pulse is coupled to a sensitive audio amplifier driving a loudspeaker, a sharp 'click' will be heard. Each 'click' from the geiger counter represents the incidence of a particle on the GM tube.

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Project 566

Pipe and cable locator

Finding ring-pulls, bottle tops and assorted junk is fine with your 'garden variety' metal detector, but if you need to find important things like water pipes, phone cables or giant gold nuggets ... you're a candidate for this project.

Phil Wait

The completed instrument. The handle is secured by bolts, to which the knobs are attached, which pass through the handle into threaded receptacles in the case panels. The handle for general use is 1120 mm long overall. We also tried a shortened handle, 610 mm long, which improves sensitivity to small objects, but decreases ground penetration. The webbing strap is an optional refinement, used to lower the unit towards the ground to improve penetration.

THIS INSTRUMENT can be used to locate metal objects buried at considerable depths. Whilst the title, Pipe and Cable Locator, suggests a purely pragmatic use – that of locating buried pipes and cables in order to avoid damaging same when excavating for some reason, the instrument can be used for the same sorts of activities the more familiar metal detectors (or 'treasure hunters') are employed – prospecting. Whilst in the form described here it will not detect the presence of small metal objects – coins, small-sized rubbish or hopefully, small gold nuggets – it will detect larger objects buried up to several metres below the surface, opening up a whole new avenue, perhaps, of mineral or treasure prospecting.

Our pipe and cable locator employs an induction balance technique, where a transmitter and receiver each have the plane of their antennas aligned at a right angle, the receiver picking up a minimum of the transmitted signal until a metal object, brought within the field of the antennas, distorts the field, producing a strong signal in the receiver.

Design

The transmitter and receiver are housed in two plastic cases which have an integral antenna attached around the lip of each. Each antenna loop consists of an aluminium extrusion bent to fit the lip of the case, one loop mating with the other so that the two cases may be clipped together, making the instrument into a single unit for transportation.

The handle has three bolts passing through it, each having a knurled knob on the 'upper' side, as can be seen in the photograph. The handle attaches to the transmitter via a threaded receptacle set into the V-groove in the dividing piece in the case (see photographs). The receiver is attached via two threaded receptacles set into the front panel.

When the two units are mounted on the handle they are positioned such that the planes of the loop antennas are at a right angle. This ensures minimum coupling between them. To permit accurate alignment, one screw is spring loaded – the one attached to the black knob at the forward end of the receiver – and this permits the angle of the receiver to be adjusted over a small range.

The transmitter is quite simple. It consists of an RF oscillator, operating at about 100 kHz, arranged such that it switches itself on and off at about 800 Hz, thus providing a modulated signal.

The receiver seems somewhat more complex, but is quite simple in principle – it has one stage of tuned RF amplification followed by an untuned, direct-coupled amplifier and a class B detector. The bursts of transmitted RF picked up by the receiver are demodulated by the class B detector and fed to a simple audio amplifier.

The class B detector is 'off' until a signal is received. The signal will turn it on, the collector current of this stage (Q5) varying with signal strength. Thus, a meter in series with Q5's collector load serves as a signal strength indicator.

A sensitivity control is arranged to vary the gain of the tuned RF stage and the following amplifier.

Construction

The cases are made of impact-resistant plastic, while the handle is made from an aluminium pipe. The hardware for this project is manufactured by Aegis Pty Ltd who will be making it available to kit suppliers (see Shoparound on page 71 for more details).

The antenna loops are each pop-riveted to the case rims. Connections to the break in each loop are made via solder lugs secured under the pop rivets at these points – this can be seen in the internal photograph of the receiver.

The best place to start is to familiarise yourself with the hardware. The details should be fairly clear from the accompanying pictures. The panels for the transmitter and receiver may be cut from a piece of masonite. The dimensions may be

obtained from the inside measurements of the cases. The various cutouts (see the photographs) around the edges should be carefully marked and either cut with a fine fret saw or filed out. The position of the holes through which the securing screws pass should be carefully marked and drilled to a suitable clearance diameter.

Two threaded receptacles have to be mounted on the receiver front panel – these take the bolts on the handle which secure the receiver to the handle, the 'forward' one being spring-loaded to allow the angle of the receiver to be adjusted. These threaded receptacles must be accurately mounted on the centre-line of the panel so that the receiver antenna loop is correctly positioned with regard to the transmitter.

The holes for the meters and switches and the receiver's speaker and sensitivity pot should be drilled out last of all. The position of these components is not all that critical, but follow the general placement indicated in the photographs. Alternatively, Scotchcal front panel artwork may be available (check your supplier) and placement of these components may be taken from the artwork. Radio Despatch Service in Sydney will make up Scotchcal front panels to order.

Construction of the electronics can follow. All components in each unit are mounted from the front panel.

The transmitter is quite simple, using only one active component. The pc board is mounted on the back of the battery test meter to simplify the mechanical construction. Start by assembling the pc board as shown, taking care with the electrolytic capacitors and the transistor. This unit has been specially designed around a germanium transistor and a silicon type *cannot* be substituted.

The pc board has been designed to accept a variety of trimmer capacitors and two different types of pot cores, one a Philips type, the other from Neosid. Both are manufactured by Aegis Pty Ltd. You will see two different circles of holes in the board. The innermost circle accepts the Philips pot core pins, the outermost, the Neosid type. Run the wires to the switch, battery and the loop antenna, keeping the wires to the loop as short as possible to avoid any stray radiation upsetting the field pattern. Twist them lightly.

The meter on the transmitter is only used as a battery indicator and may be more expensive than you wish. It can

Overall views of the completed receiver and transmitter. The antenna loops are made to fit together so that the instrument may be made into a single case for transporting. The clips and carrying straps are 'dress up' options. The V-groove visible in the transmitter panel is where the handle sits.

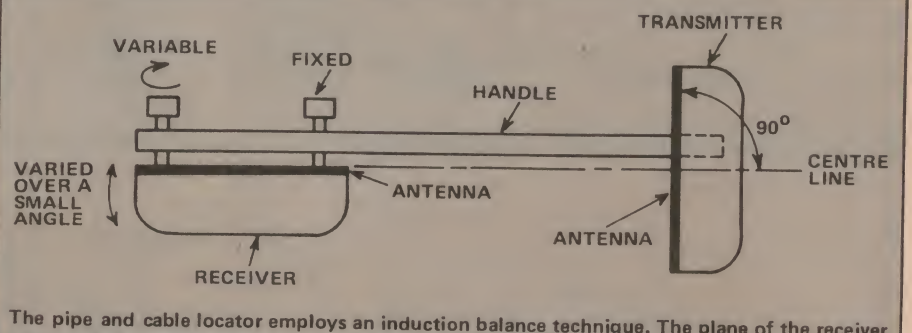
however be replaced by a LED if the value of R3 is reduced to about 1 kohm. This will increase the current drain from the battery but should not be a problem. If you stick with the meter, either a 100 μA, 200 μA or 1 mA movement can be used by choosing the value of R3 to be 100 k, 47 k, or 10 k respectively. In this case, you will have to mount the pc board on the front panel with standoffs.

The receiver is quite a bit more complex than the transmitter but as all the components are mounted on the pc board it shouldn't prove too difficult. Watch out for the orientation of the electrolytic and tantalum capacitors. Again, the pc board has been designed to accept a variety of trimmer capacitors and either the Neosid or Philips pot cores.

The meter shown is a 200 μA type. However, if it is unavailable a 100 μA movement can be used. If you do this, increase the value of R17 to 10 k and R18 to 100 k. Note that R18 is mounted off the pc board between the meter test button (PB1) and the power switch (SW1). Keep the leads to the loop as short as possible and well away from the speaker leads. The pc board is mounted behind the meter and held off the front panel with standoffs as shown in the photograph.

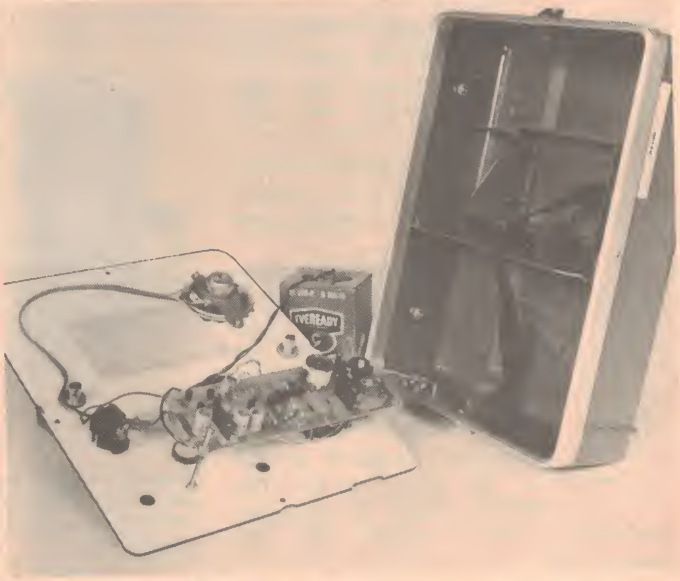
Tuning up

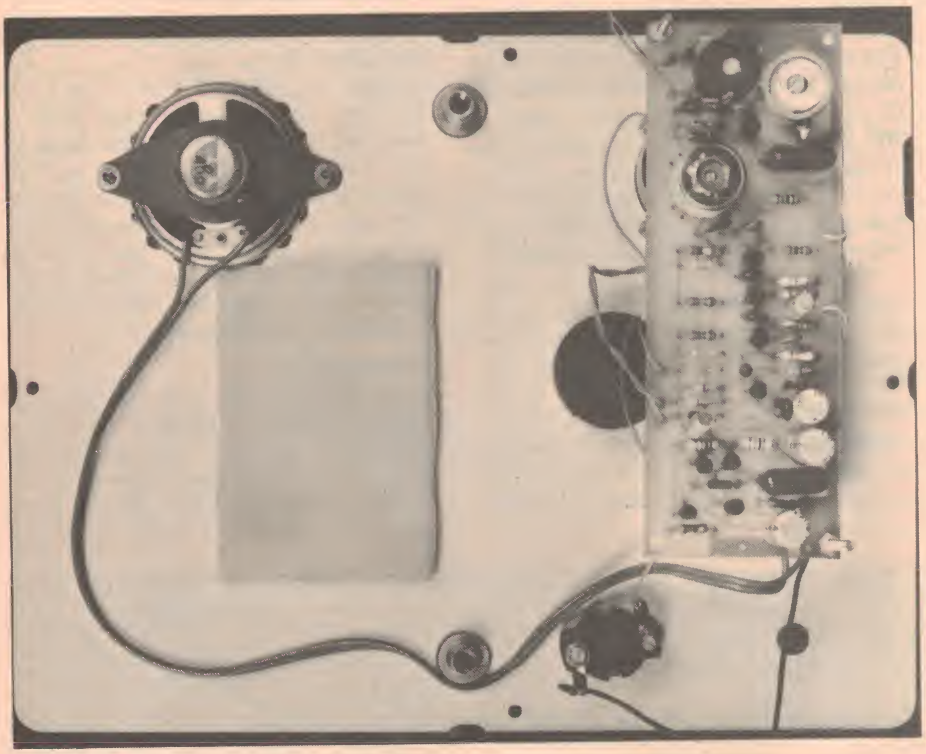
After the two units are assembled the oscillator must be adjusted for correct operation and the transmitter and receiver set to the same frequency. Lay the two units on a table about a metre apart and turn them on. By advancing ▶



The pipe and cable locator employs an induction balance technique. The plane of the receiver antenna is set along the centre line of the transmitter antenna and at a right angle to it. To permit good 'nulling' of the received signal, the plane of the receiver antenna can be varied over a small angle by means of the spring-loaded adjustment bolt in the handle at the head of the receiver.

The secret of the instrument's success is critically dependent on the construction of the handle and the cases. The cases are rigidly secured by the handle so that the planes of the antenna loops are held in the correct position. It is for this reason we have specified commercially-made hardware for this project. However, a skilled handyman, with imagination, could fashion suitable hardware from wood and chipboard. The antenna loops have to have very low resistance, hence a metal strap is necessary.

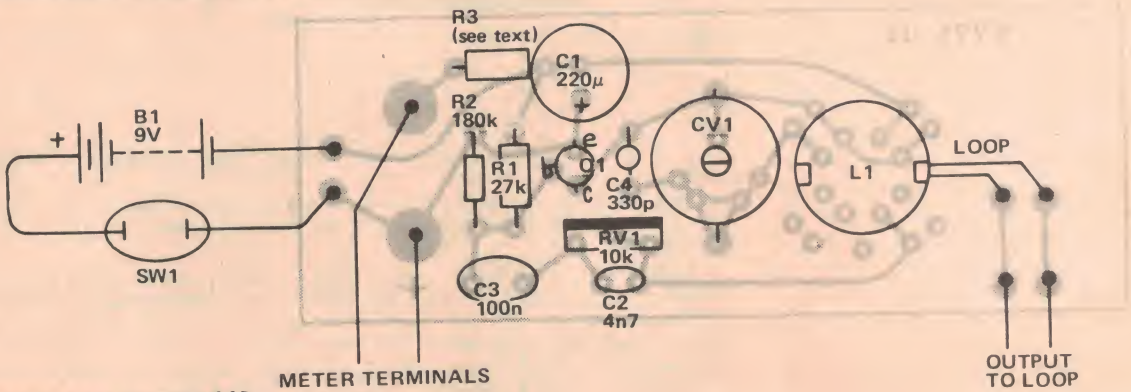




Above left
Internal view of the transmitter. We used a pull-on/push-off switch, but an SPST toggle switch will do as well. The pc board we mounted on the rear of the meter, using the terminals to support it. If you elect to dispense with the meter, the pc board may be mounted on a couple of standoffs. The panel is secured with three screws. The case shown here is from an old unit, the cases to be supplied will have a different appearance but function in the same way.

Above right
General view inside the receiver. The receiver and transmitter antenna loops were secured with pop rivets. Each loop has a 'break', with pop rivets securing the loop ends to the case. Under each of these pop rivets is a solder lug making the antenna connection. The transmitter antenna connection is the same.

Left
All the receiver components are mounted from the front panel. The two threaded receptacles — to accept the bolts on the handle — can be seen near the centre of each side of the panel. These must be accurately located along the centre line of the panel. The panel is secured to the case by four screws. The piece of sponge helps to secure the battery. The small cutouts visible on the panel edges provide clearance for the pop rivets securing the loop.



The pc board patterns are on page 113.

the sensitivity control a tone may come from the speaker. If not, adjust the trim pot in the transmitter and the tone should appear. Set the trim pot for a maximum reading on the receiver meter. The oscillator is now working correctly.

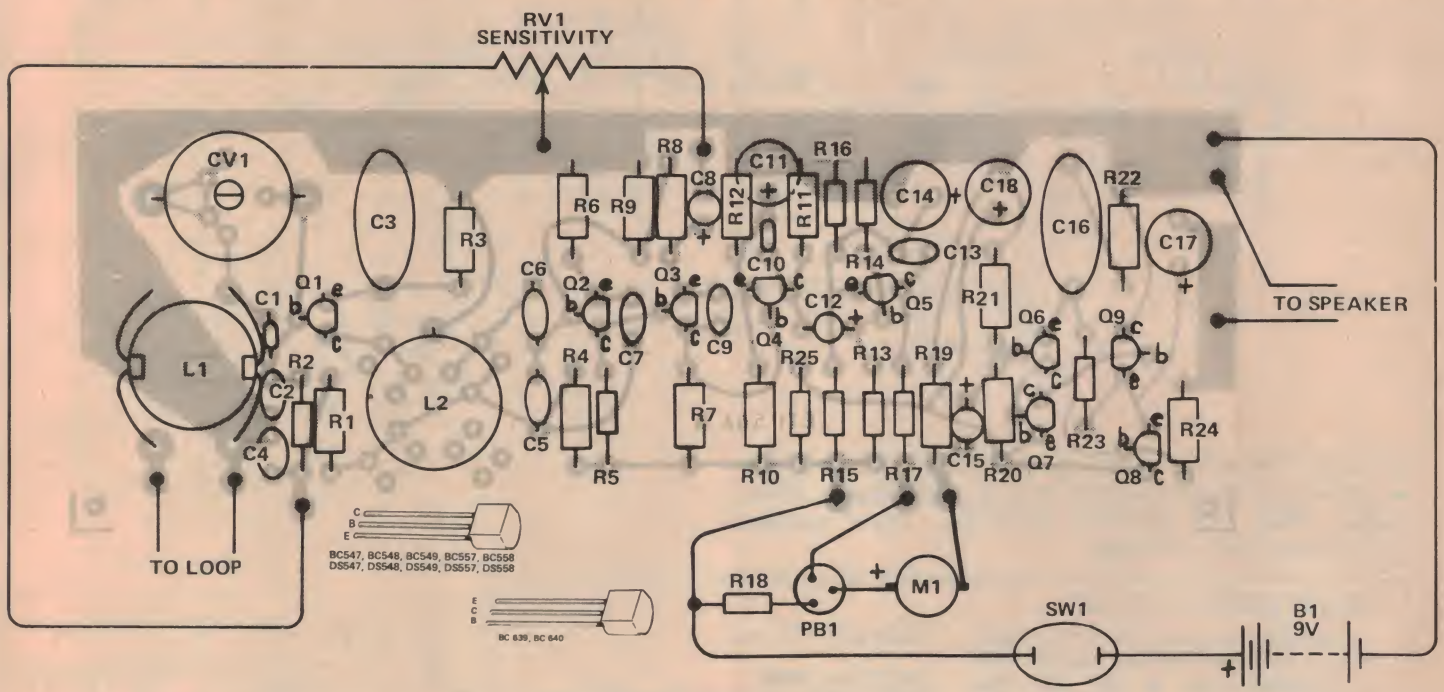
The two units now have to be set to the same frequency. The exact frequency is unimportant so long as they're the same. Lay the two units about two metres apart and set the trimmer capacitor and pot core adjustor on L2 in the *receiver* to half adjustment. Adjust the trimmer in the *transmitter* for a peak in the receiver meter, and then go back to the *receiver* and adjust the trimmer and pot core for a peak in the reading. Be careful when adjusting the pot core not to strain the thread, as it is very fragile.

During the tuning precedure it will be necessary to adjust the sensitivity control for a convenient meter reading. Be careful not to move the cases as this will change the coupling between them, giving a false variation in the meter readings.

How to use it

Condensed instructions have been included on the receiver front panel artwork as a handy reference.

Hold the instrument by the centre of ▶



PARTS LIST - ETI - 566B

Resistors ..... all ½W, 5%
R1 ..... 4k7
R2 ..... 10k
R3 ..... 1k
R4 ..... 33R
R5 ..... 82k
R6 ..... 680R
R7 ..... 12k
R8 ..... 15k
R9 ..... 6k8
R10 ..... 5k6
R11 ..... 33k
R12 ..... 22k
R13 ..... 10k
R14 ..... 220k
R15 ..... 150R
R16 ..... 10k
R17 ..... 4k7
R18 ..... 47k (see text)
R19 ..... 2k2 (see text)
R20, R21 ..... 1M
R22 ..... 56R
R23 ..... 2k2
R24 ..... 470R
R25 ..... 150R

Capacitors
C1 ..... 330p styroseal
C2 ..... 4n7 styroseal
C3 ..... 470n greencap
C4 ..... 22n greencap
C5 ..... 4n7 styroseal
C6 ..... 270p styroseal
C7 ..... 22n greencap
C8 ..... 10u 16V electro
C9 ..... 22n greencap
C10 ..... 10n greencap
C11 ..... 4u7 16V electro
C12 ..... 1u tantalum
C13 ..... 22n greencap
C14 ..... 47u 16V electro
C15 ..... 10u 16V electro
C16 ..... 470n greencap
C17 ..... 100u 16V electro
C18 ..... 47u 16V electro

Variable
RV1 ..... 1k linear pot
CV1 ..... 150p or 100p variable capacitor

Inductors
L1 ..... Aegis S284 pot core
L2 ..... Aegis S282A pot core

Semiconductors
Q1—Q3 ..... BC549, BC109
Q4, Q5 ..... BC559, BC179
Q7 ..... BC559, BC179
Q8 ..... BC639
Q9 ..... BC640

Miscellaneous
M1 - Moving Coil Meter 40mm x 48mm, University TD-48 or similar (see text); SW1 - SPST toggle or pull switch; PB1 - SPST momentary push button; SP1 - Eight ohm speaker approx 55mm dia.; Aegis box to suit, nine volt battery type 276P, ETI 566 pc board, knob, standoffs.

PARTS LIST - ETI 566A

Resistors ..... all ½W, 5%
R1 ..... 27k
R2 ..... 180k
R3 ..... see text
RV1 ..... 10k trimpot

Capacitors
C1 ..... 220u electrolytic
C2 ..... 4n7 greencap
C3 ..... 100n greencap
C4 ..... 330p styroseal or silver mica
CV1 ..... 150p compression trimmer

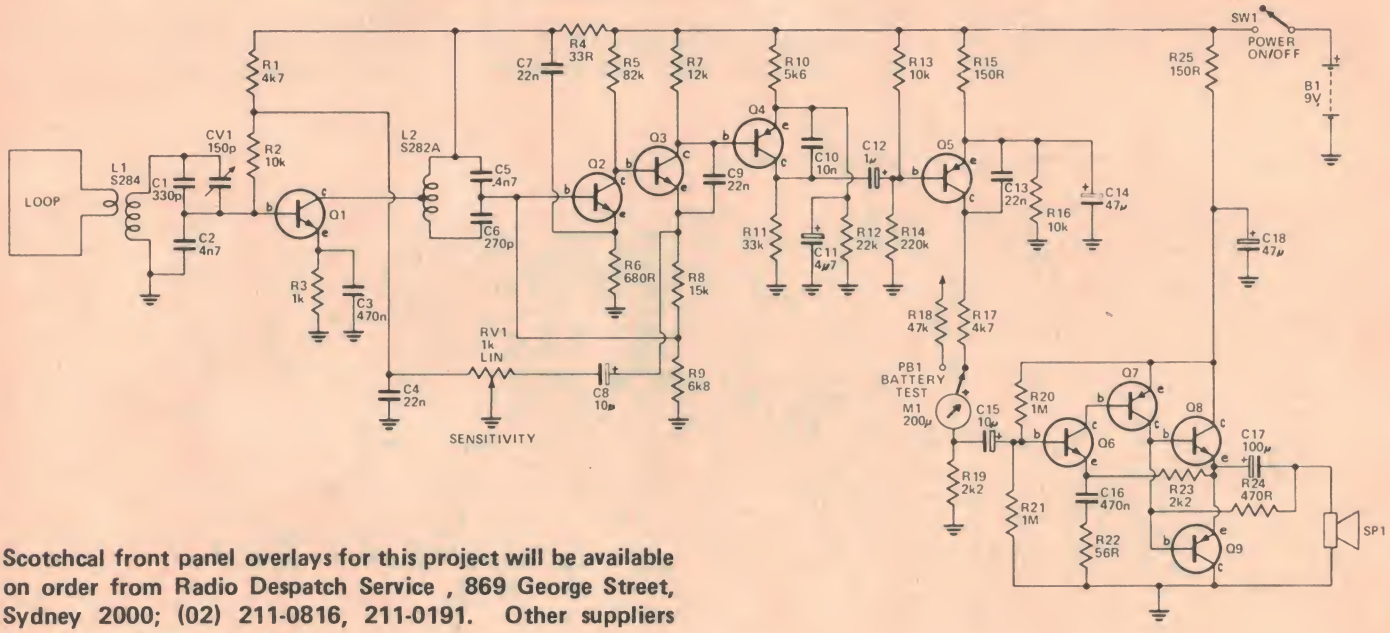
Semiconductors
Q1 ..... AC128

Miscellaneous
ETI-566A pc board; L1 - Aegis S283B; battery, 9V 276P Eveready, transmitter case, front panel; M1 - see text, nuts, bolts and special handle (see 'Shoparound' on page 71 for details on the hardware).

the bar with the receiver in front of you. The instrument should be held at arm's length, parallel to the ground. The operator's body should be midway between the two units. Wind the adjusting screw fully in (clockwise), and turn the two units on; Advance the sensitivity control to about ¾ range and a tone should appear. Wind the adjusting screw out (anti clockwise) until the tone disappears and continue turning the adjuster in the same direction until a slight indication is shown on the meter. The instrument is now ready to operate.

Walking over a buried object will cause a meter deflection and a sound from the speaker. Make sure when you are adjusting the instrument that there are no buried objects, cars, fences or pipes nearby to upset the balance.

To accurately pin-point the location



Scotchcal front panel overlays for this project will be available on order from Radio Despatch Service , 869 George Street, Sydney 2000; (02) 211-0816, 211-0191. Other suppliers may also make them available.

HOW IT WORKS – ETI 566

The general principle of how the induction balance technique of metal location works is explained earlier in the text. This description will be confined to the electronics.

TRANSMITTER 566A

Transistor Q1 is operated as a self-modulating RF oscillator. To provide RF output, Q1 and the tuned circuit – L1, C4, CV1 – are connected as a modified Hartley oscillator operating at around 100 kHz. The feedback has been arranged so that the oscillator "squeggs" at a frequency around 800 Hz, modulating the transmitted signal.

After power is applied, the circuit will oscillate at the frequency determined by the tuned circuit and C2-C3 will charge up via the rectifying action of the base-emitter junction of Q1. When this is sufficient to reverse bias the b-e junction of Q1, the RF oscillation will cease and C2-C3 will commence to discharge (via the bias resistors and RV1). Eventually, Q1 will turn on again and RF oscillation will commence once again and the whole process will repeat.

The transmitter signal is coupled to the loop antenna via a winding on L1. The trimpot, RV1, provides control over the feedback. The meter is used both as an on/off indicator and a battery level indicator. An LED may be substituted as explained in the text.

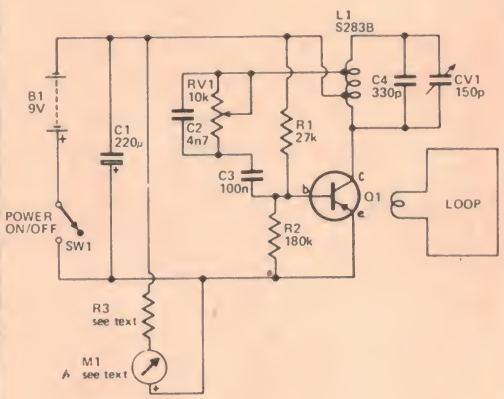
RECEIVER 566B

This consists of a single tuned RF amplifier stage followed by a broadband, direct-coupled amplifier and a class-B detector. A simple audio amplifier provides output to a loudspeaker.

The receiver antenna loop is coupled to the first tuned circuit, L1, via a link winding. The base of Q1 is impedance-matched to the tuned circuit via a capacitive 'tap'. The collector of Q1 is matched to the second tuned circuit, L2, by tapping down the coil.

A three stage broadband, direct-coupled amplifier follows L2. The base of Q2 is impedance matched to the second tuned circuit by a capacitive tap once again. Some negative feedback is provided by C7. Sensitivity is varied by simultaneously varying the base bias of Q1 and the emitter bypassing at Q3. Gain is maximum when the wiper of RV1 is at the end connected to C8.

Transistor Q5 is biased so that it is not quite turned on. When a signal appears at the end of the amplifier chain (collector of Q4), Q5 will turn on, the base-emitter junction rectifying the signal, the modulation then appearing at the collector. As the signal strength increases, Q5 will turn on harder, thus the collector current may be used as an indication of signal strength.



Resistors R17 and R19 (plus the meter) form the collector load of Q5. Audio is tapped off via C15 and passed to the audio amplifier.

The audio amplifier employs a complementary-symmetry output stage (Q8, Q9), transistors Q6 and Q7 being configured as a modified Darlington driving stage. The frequency response is 'peaked' with the RC network of C16 and R22. Feedback from the output to the input is provided by R23 and feedback around the output stage is provided by R24. Any small speaker having an impedance between 8 ohms and 40 ohms may be used.

of an object, cross it from each side and with your heel, mark the position on the ground where the signal is strongest. The object will be located mid-way between the two heel marks.

Something can be learnt about the shape of an object by passing over it from different directions. Obviously a pipe will be easy to identify because it will run along the ground for a long way. Other objects will appear more symmetrical.

Careful operation of the sensitivity control can help accurately locate an object. Having located something with the instrument set at the normal settings (as described above) reduce the sensitivity a small amount and repeat your crossing of the location. The signal will be heard over a much smaller distance. This method is useful for separately locating closely adjacent pipes.

Greater depth penetration can be obtained by lowering the instrument to the ground by means of a strap attached to the handle. One is shown with the instrument in the photograph on the first page of this article. The instrument is first adjusted as per normal, then lowered to the ground as close as you can go without upsetting the receiver indication. The instrument should be held so that the receiver is angled a little downward. It may be necessary to reduce the sensitivity slightly.

The best way to get used to the instrument is to experiment with known buried objects. You will note that objects which are only at a shallow depth give a maximum indication when they are directly beneath the receiver. Objects buried more deeply give a maximum indication when they are about midway beneath the transmitter and receiver.

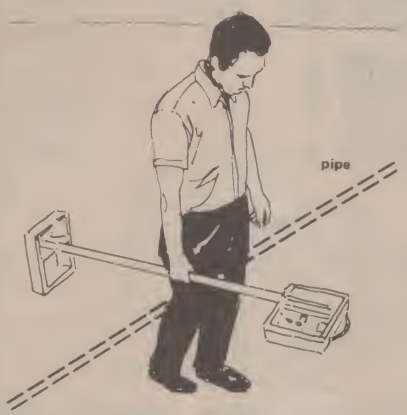
The two units may be operated separate from the handle to locate the direction of a pipe, lateral pipes and bends. The accompanying diagrams show how to use the instrument in this mode.

Newly buried objects can be difficult to locate as they give a poor indication. The detectability of an object improves with time as the soil surrounding the object compacts and corrosion improves the soil conductivity.

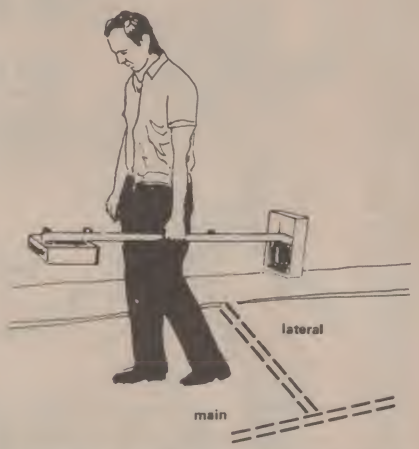
When operating in conductive soils (heavily mineralised), you will need to reduce the sensitivity and adjust the null as previously outlined.

As with any instrument, it takes practice and experience to be able to use it effectively. ●

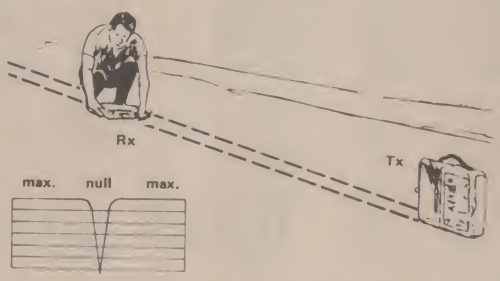
LOCATING PIPES AND CABLES



General use of the instrument. With the receiver correctly adjusted for a null, proceed along a line, or parallel lines, until an indication is received. For accurate location, cross the indication point from each side and mark with your heel where the indication is strongest. The location of the buried object is between the two marks.

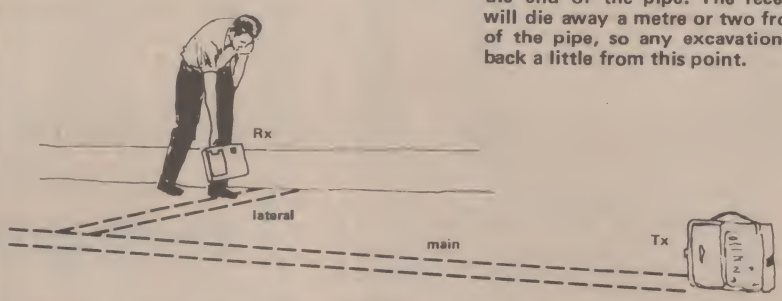


Locating a lateral pipe that joins onto a main. Having determined the direction the main runs, walk parallel to it, several metres away. Lateral pipes will produce an indication in the receiver.



Locating the direction a pipe runs using the separated transmitter and receiver. The transmitter is stood up such that the plane of the antenna runs roughly in the pipe's expected direction. With the receiver held horizontal, go about 10 metres away and pass the receiver back and forth to find a null. A very sharp null will be found. The position of the minimum pinpoints the centre line of the pipe. Moving the transmitter and receiver successively along the line determined will locate the full course of the pipe.

Locating the end of a pipe. Having determined the position of the pipe, hold the instrument as shown – the received signal will be quite strong until you pass the end of the pipe. The received signal will die away a metre or two from the end of the pipe, so any excavation should be back a little from this point.



Locating a lateral pipe with the receiver and transmitter separated. Using this method, with the receiver held vertical, a peak indication is obtained over the location of the lateral pipe. Bends can also be found in this manner.

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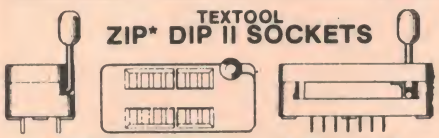

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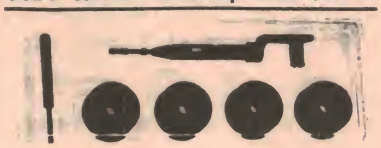

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Fuzz/sustain unit for guitarists

Ron Keeley
Jonathan Scott

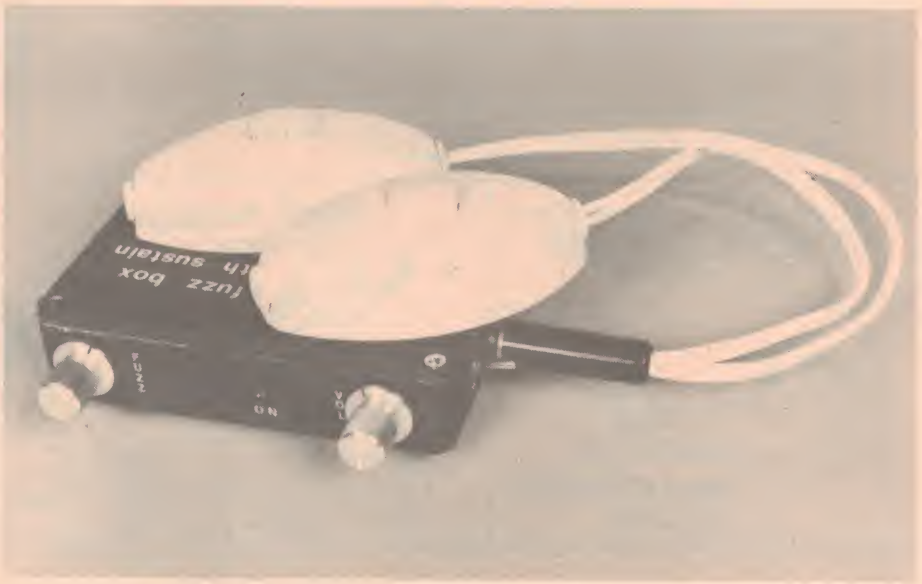
For that raunchy sound beloved of electric guitarists the world over, this simple little project is just the thing.

THE INVENTOR of the fuzz-tone is lost in history (rugged country, that), along with the discoverer of the wheel, the first chef, and the architect of square corners. However, his legacy is with us still, to the joy of those who like their music *loud*, and the despair of those who can't stand it that way!

Like the first bar-b-que, the first fuzz-tone was probably an accident — a blown speaker, perhaps, or a badly overdriven amplifier. However, the essential nature of the phenomenon did not long remain hidden, and keen guitarists soon had the fuzz by the short and curlies.

Fuzz-tone is to guitar what salt is to meat — it adds flavour and body. The ETI Fuzz Unit, based on the 'clever fuzz-box' circuit which appeared in the January '79 ETI, has an added bonus in an inbuilt sustain circuit, adding a bit of extra spice to the idea.

The device offers three distinctive sounds, in addition to the 'straight through' option: sustain, fuzz with sustain or fuzz without sustain.



How we did it

To explain how these sounds are realised, we have to consider the circuit diagram.

The input amplifier, IC1, is required to give the system some overall gain, to boost the treble response, and to present the correct load impedance to the instrument. The mid-range gain is set to 5, allowing 1 V peak-to-peak input signals before distortion, and producing the largest possible dynamic range. The frequency response is flat from 20 Hz to about 2 kHz, after which an 8 dB step provides a gentle treble boost up to 20 kHz, where the response is flat from 20 Hz to about 2 kHz, after which an 8 dB step provides a gentle treble boost up to 20 kHz, where the response is rolled-off.

Following the input stage is IC2/1, one half of an NE 571 compander IC configured as a conventional compressor with a fixed compression ratio of 2:1. This compression effectively halves the dynamic range of the incoming signal by attenuating high level signals and boosting low level ones; thus the signal hangs on — "sustains" — for much longer than it otherwise would. The compression also provides a constant ▶

HOW IT WORKS — ETI 562

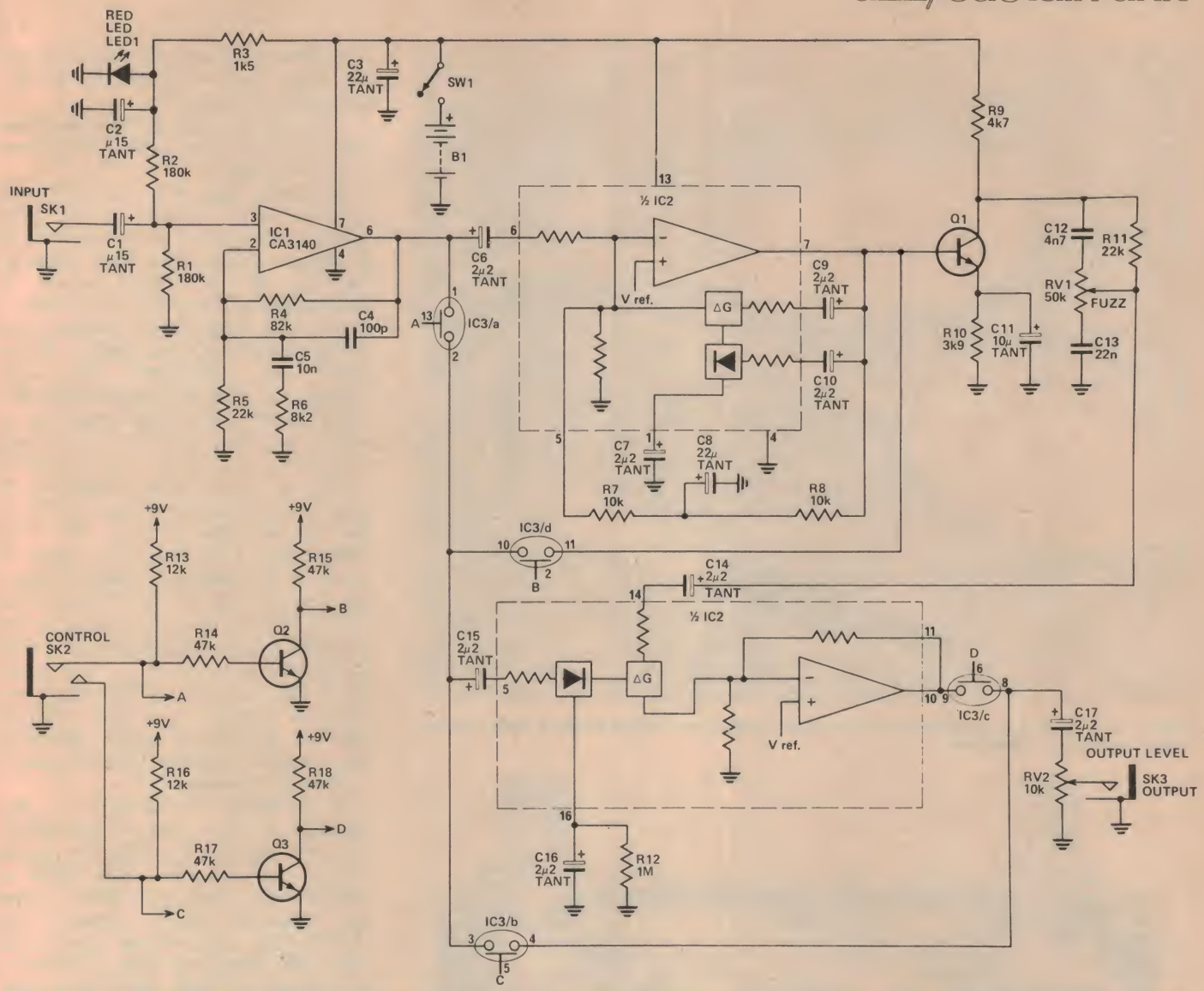
The input amplifier is a CA 3140, chosen for its low noise. The input impedance of the device is quite high, so the effective value is determined by the parallel combination of R1, R2; the values used give an impedance of 90k. R1 and R2 can be as low as 10k or as high as 1M, as long as they are the same and within this range.

The bias for the CA 3140 is filtered and regulated by R3, C2 and LED1; the LED also acts as a 'power on' indicator! The LED must be RED as other colours have a different forward voltage. The stage gain of 5 is set by the ratio of R4 and R5, while C4, C5 and R6 tailor the frequency response as described in the text.

IC2 is a dual gain control IC, NE 571, which may be set-up to implement a number of signal processing functions. Each half of the IC consists of a full wave rectifier acting on the control input, a variable gain cell (signal input), an operational amplifier and a bias system. The blocks may be set-up as, for example, a compressor, an expander, a limiter or an envelope follower. The compression/expansion ratio is internally set at 2:1 while the attack and release times are determined by an external timing capacitor and an internal resistor, the attack-to-decay time ratio is internally set at 1:5.

It is possible to vary both the compression ratio and the attack/decay ratio by the use of complex external circuitry, however the internally set values are adequate for the purpose of this gadget.

IC2/1 is configured as a compressor. The control signal is rectified and fed to an internal summing node. The rectified current is averaged by the external capacitor C7, and the average rectified current controls the gain of the variable gain cell ΔG. The gain cell is connected as an expandor in the feedback loop of the op-amp; a 3dB increase in the gain of the ΔG cell, producing a 6dB increase in feedback current to the summing node at



the op-amp input. If the input rises 6dB, the output can rise only 3dB.

The speed with which the gain changes to follow the input signal is determined by the rectifier filter capacitor C7. A small value will follow rapidly but will not fully filter low frequency signals on the control input. Any ripple on the gain control signal will modulate the signal passing through the ΔG cell, producing third harmonic distortion, so there is a trade-off between fast attack/decay times and distortion. C7 should not be reduced below about 0µ47.

The ΔG cell has a built-in compensation scheme for temperature variations and for cancelling odd harmonic distortion. A THD trim terminal is provided, but not used here, for cancelling even harmonic distortion caused by internal offset voltages. The operational amplifier is also internally compensated.

The non-inverting input is tied to an internal reference voltage and the summing node at the inverting input is tied internally to the ΔG cell output as well, the invert input is brought out of the package directly and via an internal resistor. This allows the gain of the stage to be controlled by internal components only or, as we have done, by an external network (R7, R8, C2). The output stage is capable of ± 20 mA output current.

For maximum dynamic range, the control (rectifier) input current should be as large as possible but should not exceed 300 µA (3 V using only the internal resistor). Maximum ΔG cell input current is 140 µA (2.8 V with internal components only).

Q1 is a high gain amplifier which is always driven into hard clipping, as described in the text. R11, RV1, C12 and C13 form a tone control network which varies the fuzz-tone by rolling-off the top end. The clipping amplifier feeds the second half of IC2 which is connected as an envelope follower.

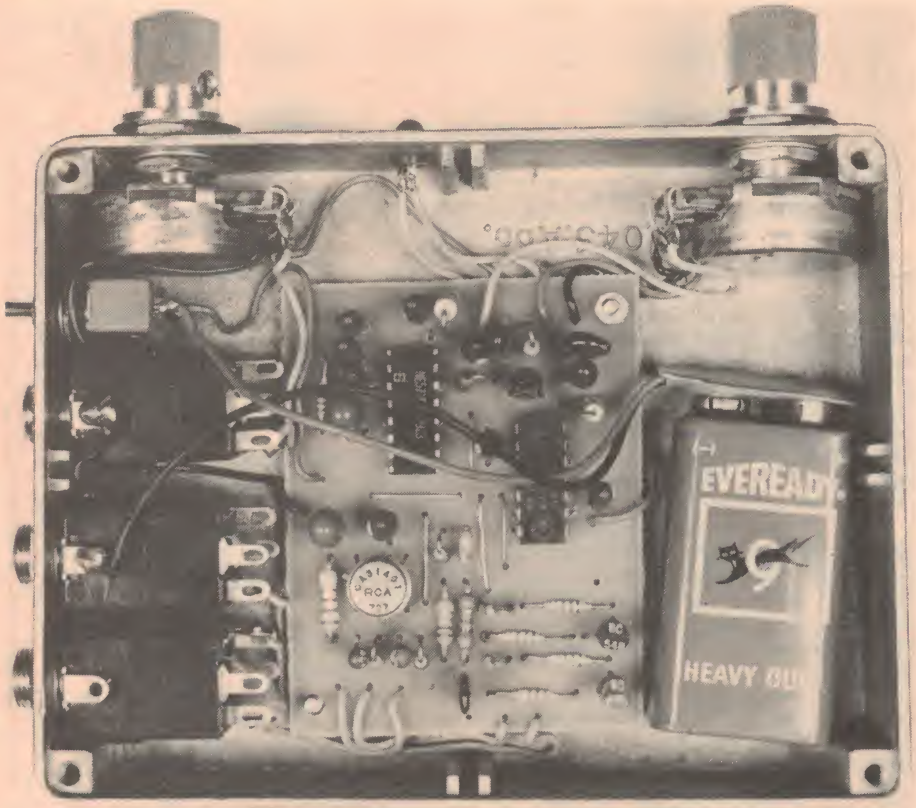
In the usual expander configuration the control and signal inputs are tied together, so that a 3 dB rise or fall at the input produces a 3 dB variation in the gain of ΔG, giving a 6 dB rise or fall at the output.

When connected as an envelope follower the control input is the signal whose amplitude envelope is being impressed on the straight-through signal, and a 3 dB variation of the control input will produce a 6 dB rise or fall at the output.

The attack/decay times of the follower are set by C16; it is best not reduced below about 0µ1.

The switching system uses a CA 4016 quad analog switch with Q2 and Q3 as drivers. With both control lines floating SWs A and C are closed, B and D open. When the fuzz control line is grounded Q3 cuts-off, opening C and closing D; similarly when the sustain line is grounded, A opens and B closes.

The switches we used are single-pole, double-throw types which may be found in some hardware stores or electrical wholesalers.



We housed the fuzz unit in a diecast aluminium box, type 043B. It's not as much of a squeeze as it looks. A piece of sponge rubber will secure the battery.

level drive to the clipping stage, making the fuzz sound independent of the instrument input level.

For a more precise description of the NE 571 Compander, refer to the 'How it works' section.

The fuzz stage, Q1, is a high gain amplifier stage. Because of the high, constant drive from the compressor it is always driven into hard clipping, resulting in an output which is substantially a squarewave. The output of the fuzz stage is fed through a tone control which varies the quality of the sound by rolling-off the high frequencies – one of the reasons for the treble boost at the input stage was to ensure that there would be some high frequencies to roll-off at this point!

The by now well-and-truly-fuzzed signal is fed to the signal input of IC2/2, the second half of the NE 571 Compander. This time the device is set-up as an envelope follower with a signal input and a control input; the output of IC2/2 is whatever frequencies are applied to the signal input but with the amplitude envelope of the signal fed to the control input (for details see 'How it works'). It is this envelope follower, plus some simple switching, which makes The Fuzz Unit so versatile – of which more shortly!

A deliberate modification to the envelope follower ensures that IC2/2 shuts-off completely when the signal on the control input falls below a certain level. This is a simple 'noise gate' function which prevents the amplification of low-level signals and noise, eliminating the hisses and buzzes of unwanted sounds and the squeals and howls of unexpected feedback! This function operates only when Fuzz function is selected.

As we mentioned earlier, The Fuzz Unit is capable of producing either sustain, fuzz with sustain, or fuzz without sustain. These variations are achieved by selecting the appropriate output and the appropriate drive to the control input of the envelope follower.

The switching system is entirely electronic, so the guitar signal never leaves the box even if the footswitches themselves are a dozen yards away. The signal is not required to travel long lengths of cable, and so is not attenuated or subject to interference. Also, single-pole non-audio type switches may be used, allowing a larger choice of switch types (audio quality footswitches are hard to find at the moment!).

Two switch lines are used to control

four electronic switches operating as two sets of change-over switches. One line controls SW A and SW B, (sustain on/off), the other controls SW C and SW D (fuzz on/off).

If neither fuzz nor sustain is selected, SW A and SW C are closed while SW B and SW C are open; the output of the unit is derived from the input pre-amplifier (so it will be a little louder and a little brighter than the guitar itself) via A and C.

If sustain is selected SWs A and B change over and the output is from IC2/1.

Selecting fuzz closes SW D and opens SW C. Whether it is fuzz with sustain or fuzz without sustain now depends on the position of the sustain select switch. If sustain is selected the drive to the control input of the envelope follower is the compressed signal from IC2/1; compression followed by expansion restores the amplitude envelope of the signal, so the output will have the dynamic characteristics of the original guitar sound, but will sustain for longer than usual. If sustain is not selected, the envelope follower control input is from the pre-amp, therefore the output of IC2/2 is the original signal expanded. Because of the value chosen for C7 and C16, the Fuzz Unit will produce a rather long 'delayed attack' effect when in this mode. If a shorter attack is wanted, C7 and C16 should be reduced; this will give a faster attack in 'fuzz without sustain', and enhanced attack in 'fuzz with sustain'.

Construction

The major problem in constructing this project is the non-availability of certain components. We were unable to find a reliable supply of audio-quality footswitches, and for this reason opted for external switching using a pair of Clipsal No. 360 Series 250 V/10 A footswitches. These are definitely not your usual stage gear, but they are very rugged and work very well indeed. Also, they are cheap!

For a touch more class use a commercial dual footswitch such as the Companion or the Roland FS 2 (around $15). With a bit of juggling you may be able to mount the project in one of these boxes. We used an 043B diecast aluminium box which is about the smallest possible container. If you are lucky enough to find a pair of audio footswitches and wish to mount them in the top you will need a deeper box than the 043B.

The usual method of switching the battery in effects boxes is to use a 6.5 mm socket with a separate pair of switching contacts – power is applied whenever a guitar is plugged in. We were unable to locate any of these sockets, so we have used an on/off switch.

Once the box has been drilled, the pc board should be assembled according to the circuit and layout diagram. Be sure that polarised components are correctly installed. The ICs should be put in last, as they are electrically fragile.

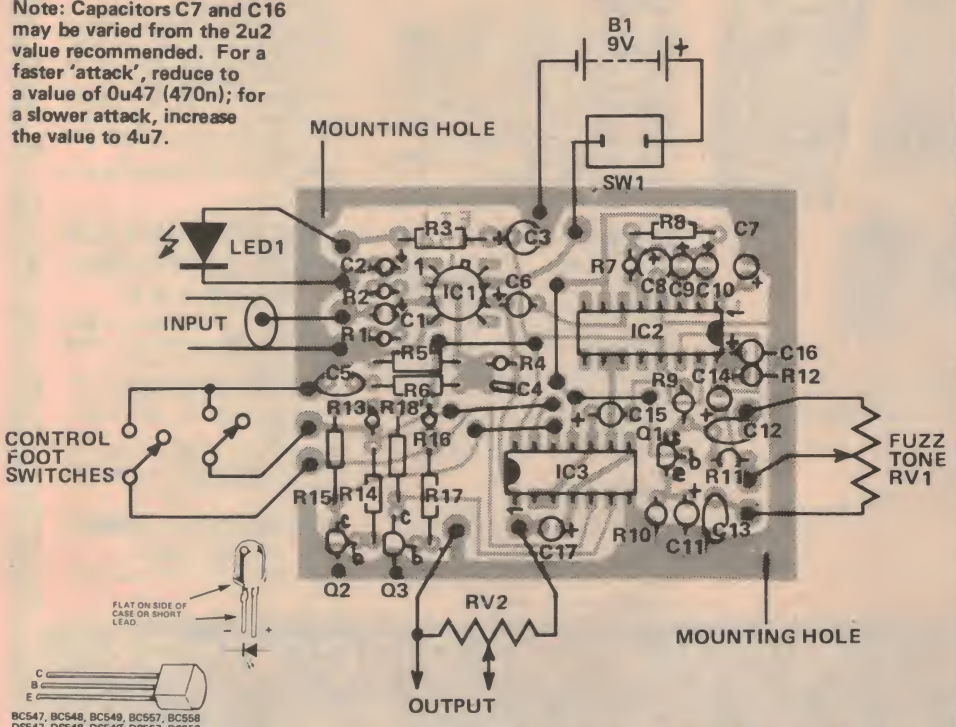
All solder joints should be clean and neat, with no stray connections across tracks on the pc board. Finally, interconnect the various major components as shown in the wiring diagram, using the shortest possible lengths of wire; use care when soldering the LED, as they are very heat sensitive and easily cooked.

Use insulated wire, and make sure that nothing is shorting to the box; the battery is best restrained by using a piece of double-sided tape.

After carefully checking that all connections are as they should be, apply power and you've got 'The Fuzz'.

Best results are obtained with the guitar output as high as it will go without causing distortion on loud notes when The Fuzz is switched to sustain only. ●

Note: Capacitors C7 and C16 may be varied from the 2u2 value recommended. For a faster 'attack', reduce to a value of 0u47 (470n); for a slower attack, increase the value to 4u7.



The pc board patterns are on page 113.

PARTS LIST - ETI 454

Resistors ..... all ½W, 5%
R1, R2 ..... 180k
R3 ..... 1k5
R4 ..... 82k
R5 ..... 22k
R6 ..... 8k2
R7, R8 ..... 10k
R9 ..... 4k7
R10 ..... 3k9
R11 ..... 22k
R12 ..... 1M
R13 ..... 12k
R14, R15 ..... 47k
R16 ..... 12k
R17, R18 ..... 47k
RV1 ..... 50k lin.pot
RV2 ..... 10k log. pot

Capacitors
C1, C2 ..... 15u tantalum
C3 ..... 22u tantalum
C4 ..... 100p disc ceramic
C5 ..... 10n greencap
C6, C7 ..... 2u2 tantalum
C8 ..... 22u tantalum
C9, C10 ..... 2u2 tantalum
C11 ..... 10u tantalum
C12 ..... 4n7 greencap
C13 ..... 22n greencap
C14—C17 ..... 2u2 tantalum

Semiconductors
Q1—Q3 ..... BC548
LED1 ..... TIL 22OR or similar
IC1 ..... CA 3140
IC2 ..... NE 571
IC3 ..... CD4016

Miscellaneous
Metal box, 043B or similar; pc board - ETI 454; 9V battery, type 216; DPST miniature switch; two phone-jack sockets, mono; 1 phone jack socket, stereo; two knobs; pc board spacers; nuts and bolts.

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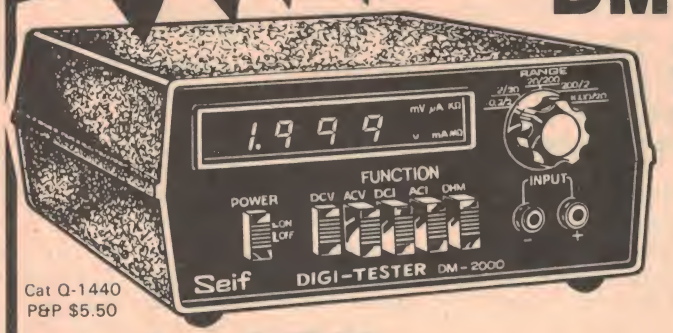

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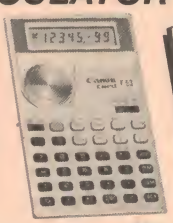
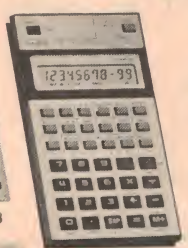
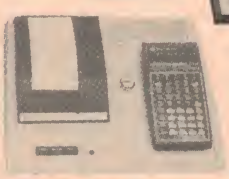


Canon F53



Casio fx510



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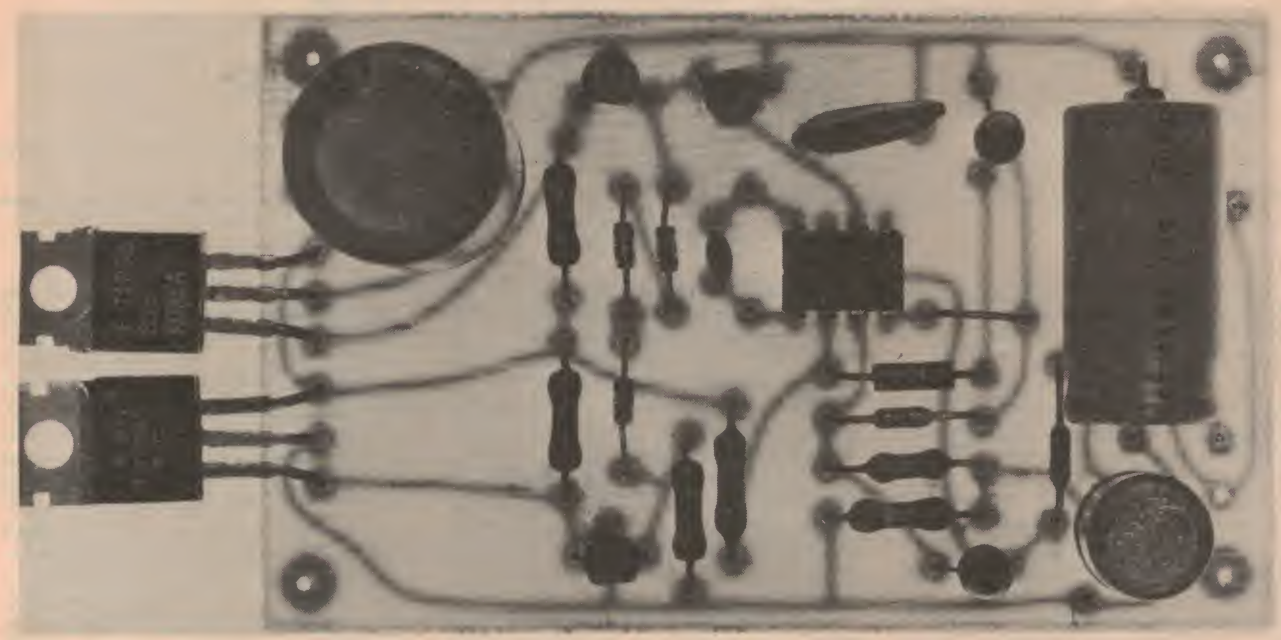


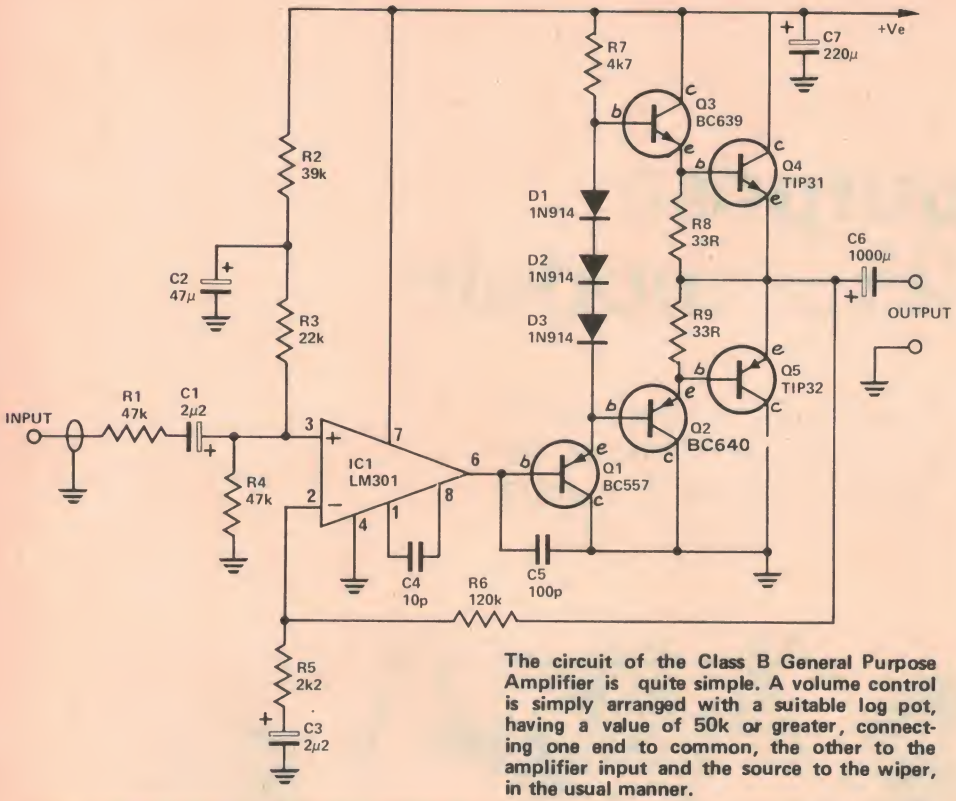
WHEN DESIGNING and building electronic projects, one of the most often needed circuits is a simple, low cost audio amplifier stage capable of driving a 4 or 8 ohm loudspeaker. This amp module is capable of driving a 4 ohm load with over 20 watts. This is more power than is necessary in many applications but it is a simple matter to decrease the maximum output power by simply decreasing the supply voltage. The table gives the relationship between output power and supply voltage. At lower power levels the amp module will not require any form of heatsinking. Some experimentation will be necessary to determine the amount of heatsinking that should be used at higher power levels.

The circuit gives maximum power out with an input level of about 300 mV which should be easily obtained by the stage used to drive the amp module. This figure can be changed slightly by varying the amount of negative feedback. Resistor R6 is the negative feedback resistor and, together with R5, determines the overall gain of the circuit.

Specifically, the gain of the circuit is given by R6/R5. In the circuit shown this becomes

$$\frac{120k}{2k2} = 54.55.$$

The output voltage will be this figure, multiplied by the input signal voltage. So, for an input voltage level of 100 mV RMS the output level will be 100 mV x 54.55 = 5.45 volts RMS, which is equivalent to 3.7 watts into an 8 ohm load. If you have only 50 mV available, for example, and wish this signal level to drive the amp to 3.7 watts, it would be necessary to halve the amount of negative feedback, thereby doubling the gain of the amplifier. The negative feedback resistor would have to be doubled in value to 240k. In practice,▶



The circuit of the Class B General Purpose Amplifier is quite simple. A volume control is simply arranged with a suitable log pot, having a value of 50k or greater, connecting one end to common, the other to the amplifier input and the source to the wiper, in the usual manner.

PARTS LIST - ETI 453

Resistors all ½W, 5%
- R1 . . . . . 47k
- R2 . . . . . 39k
- R3 . . . . . 22k
- R4 . . . . . 47k
- R5 . . . . . 2k2
- R6 . . . . . 120k
- R7 . . . . . 4k7
- R8, R9 . . . . . 33R

Capacitors
- C1. . . . . 2µ2 35V tantalum
- C2. . . . . 47µ 25V electrolytic
- C3. . . . . 2µ2 35V tantalum
- C4. . . . . 10p disc ceramic
- C5. . . . . 100p disc ceramic
- C6. . . . . 1000µ 25V electrolytic
- C7. . . . . 220µ 25V electrolytic

Semiconductors
- D1–D3. . . . . IN914 signal diode or similar
- Q1 . . . . . BC557
- Q2 . . . . . BC640
- Q3 . . . . . BC639
- Q4 . . . . . TIP 31
- Q5 . . . . . TIP 32
- IC1 . . . . . LM301

Miscellaneous
- ETI 453 . . . . pc board

HOW IT WORKS

The amplifier can be considered in two sections, the voltage amplifier built around the LM301 op-amp and the current amplifying output stage.

The LM301 is an IC operational amplifier that is used to amplify the input signal up to the voltage levels needed by the output stages. Input to the op-amp is via the 47k resistor R1 and the 2u2 tantalum capacitor, C1. The input impedance at the non-inverting input of the op-amp is determined by resistors R4 and R3. R4 is connected directly to ground and the 47u electrolytic capacitor C2 represents a short circuit to ground for any ac signals flowing through resistor R3. As far as ac signals are concerned, R3 and R4 represent parallel resistance to ground. As a result, the impedance at this point is around 15k. R1 serves to increase the input impedance to approx 60k: R1 in combination with C1 also determines the lower frequency 3 dB bandwidth point of the circuit, setting it to around 10Hz.

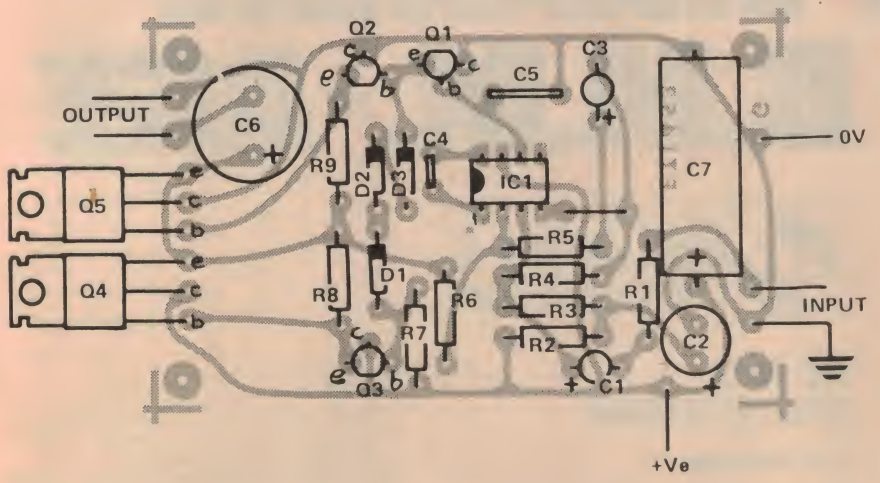
The LM301 is normally used with a split supply i.e: positive and negative supply rails. Since the objective of this design was to construct a general purpose amplifier module and its supply would, in many instances, be taken from an existing power supply, the circuit was designed to operate from a single supply. For this reason, the op-amp must be biased up to around half supply. This is accomplished by the resistors R2, R3 and R4. R2 and R3 form the upper half of a potential divider, R4 forming the lower half. The resistors chosen set the voltage on the positive input of the LM301 to about 0.44 of the supply voltage. Since these resistors are biasing the non-inverting input of the op-amp, any noise present on the positive supply rail would be communicated directly to the input of the amplifier through these biasing resistors. To prevent this, capacitor C2 was placed so as to represent a short circuit to noise voltages on the supply. This is much more effective than simply filtering the power supply (which must be done as well). In this configuration, the capacitor is fed from the 39k resistor R2, instead of directly from the positive supply as would be the case if C2 was used as a simple supply decoupling capacitor.

At audio frequencies, C2 will represent an impedance very much lower than 39k, effectively shorting out noise currents through R2. This would not be the case if R2 were not present, as the impedance of the supply would be a fraction of the impedance of the capacitor.

The amplified signal from pin 6 (output) of the LM301 is fed to Q1, which acts as the first current amplifier stage. This provides a reasonably low output impedance necessary to drive the remaining output stages. Diodes D1, D2 and D3 maintain about 1.8 volts between the bases of Q2 and Q3. These two transistors will drop 0.6 volts across the base – emitter junctions. This leaves 0.6 volts across the two 33 ohm resistors, R8 and R9. Each resistor will drop 0.3 volts, holding this voltage across the base emitter junctions of the output transistors. Since these devices, like the driver transistors, require 0.6 volts to turn on, they will remain off until the signal supplies the necessary additional 0.3 volts.

Capacitor C6 isolates the dc voltage on the emitters of the output transistors from the loudspeaker. C7 provides supply decoupling. If the amp module is used to deliver 10 watts or more, additional supply decoupling will probably be necessary.

Negative feedback is supplied by the potential divider formed from resistors R6 and R5. The capacitor C3 represents a short circuit to ground for ac signals in the audio range. Audio frequencies will therefore see R5 and R6 as a potential divider. The overall gain of the circuit will be determined by the value of R6/R5. (In this case, equal to 54.55). As the frequency decreases the impedance of C3 will increase, decreasing the gain of the circuit by increasing the amount of negative feedback. At very low frequencies, the gain of the circuit is reduced virtually to unity. This ensures that the voltage on the emitters of the output devices is stable.



Overlay showing placement of components.

The pc board pattern is on page 113.

a 220k resistor would be used. Note also that in order to obtain 3.75 watts it would be necessary to provide a supply rail of around 24 volts.

Since the project was to be a general purpose amp, it was essential that the design be robust and reliable. Class B was chosen for this reason as it has no bias current in the output stage and requires no set up procedure. The output devices are actually off, being switched on by the signal itself.

Construction

Start by soldering the resistors and capacitors into their positions on the printed circuit board. The electrolytic and tantalum capacitors must be placed on the board with the correct orientation. These are capacitors C1, C2, C3, C6 and C7. The printed circuit board overlay shows the correct orientation for these components on the board.

Solder the transistors and diodes in place, being careful that the transistors are inserted in the correct locations. Every transistor used in this project is different and as such, they are not interchangeable. Finally, solder the IC and wire link into position. Orient the IC so that the 'notch' points towards the output transistors.

Connection to the input of the power amp is best made with shielded cable to decrease the possibility of hum being induced into the amplifier. ●

TABLE 1

SUPPLY VOLTAGE	POWER INTO 8 OHMS	POWER INTO 4 OHMS
9	0.13 W	0.25 W
12	0.5 W	1 W
18	1.7 W	3.52 W
22	3.13 W	6.25 W
26	4.5 W	9 W
30	8 W	16 W
35	10.13 W	20.25 W

These are measured power output figures for different supply voltages. Powers quoted are at the onset of clipping.

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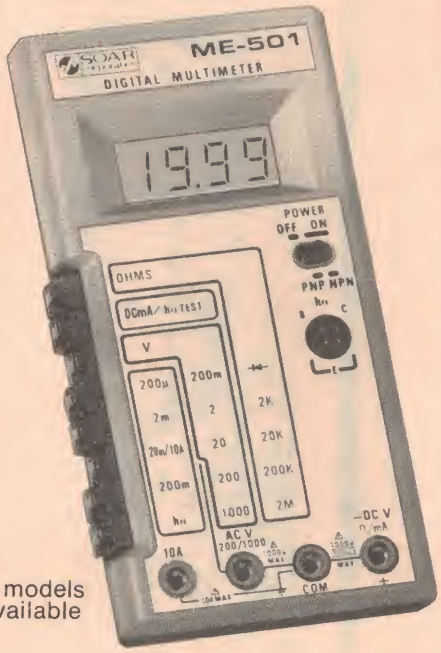

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AC Voltage

Range: 1000V
Input R: 10 M Ohm
Accuracy: I (1 percent of rdg plus 5 dgt)
Overload protection: 1200 Vrms

DCmA:

Ranges: 200 uA, 2mA, 200 mA, 10A
Voltage Burden: 250mV maximum at F.S. except 10A range, 5.00 mV
Accuracy: I (1.2 percent of rdg plus 2 dgt)
Overload protection: 0.5A/25DV Fuse

Resistance:

Ranges: 2k, 20k, 200k, 2M, Diode test
Accuracy: I (1 percent of rdg plus 2 dgt)
Overload protection: 250 Vdc/rms

Transistor Hfe Checker:

Range: 0 — 100 (IB 10 ma)
Accuracy: I (10 percent of rdg plus 2 dgt)

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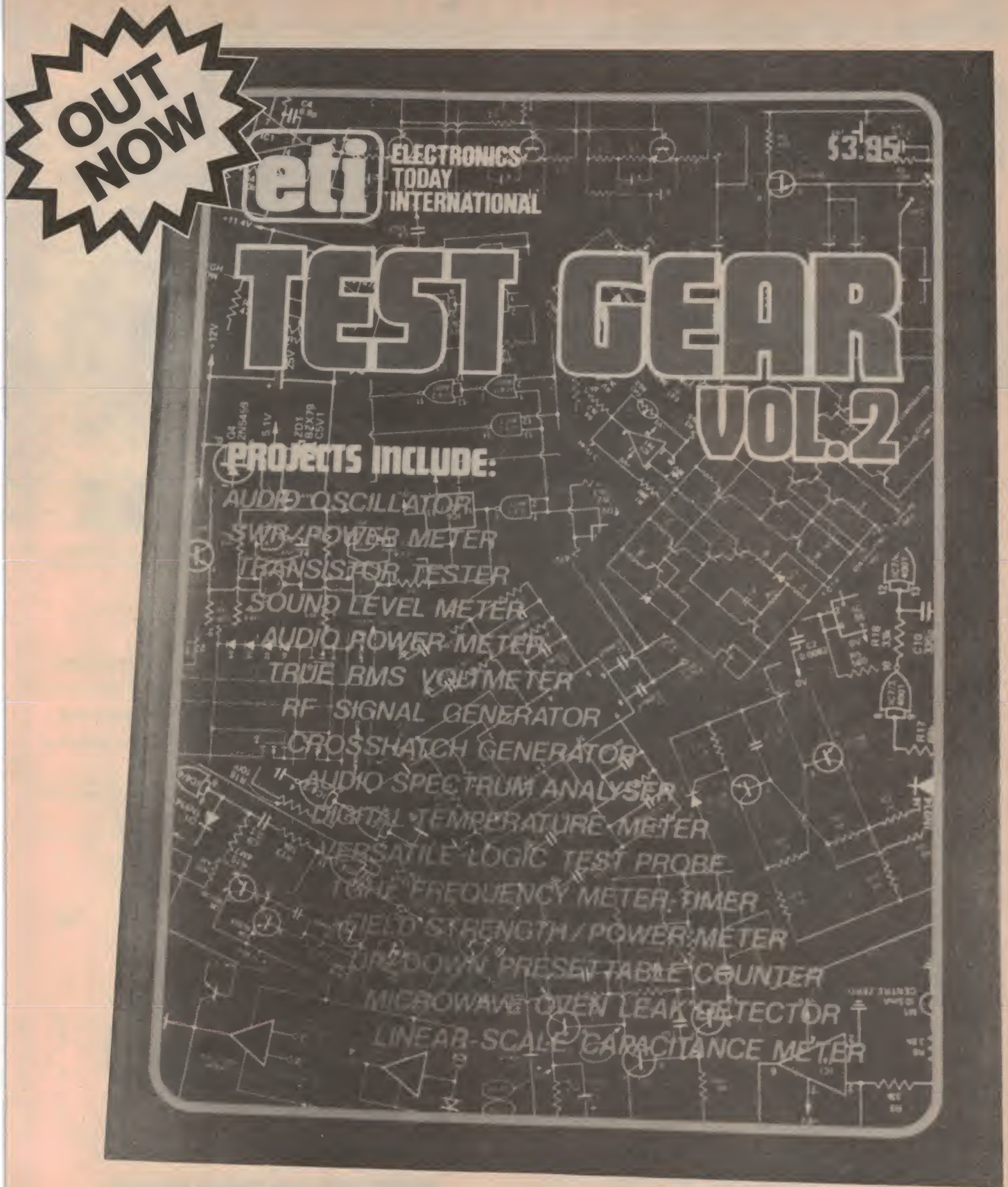

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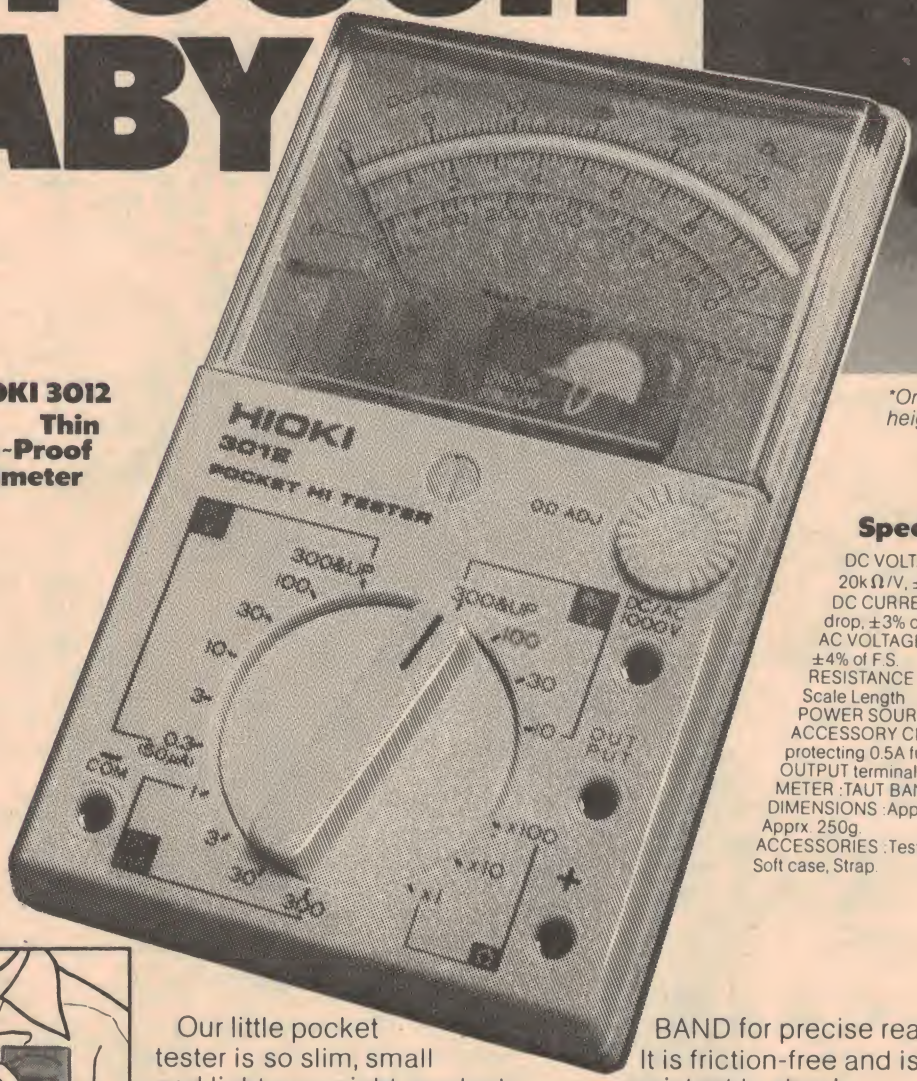

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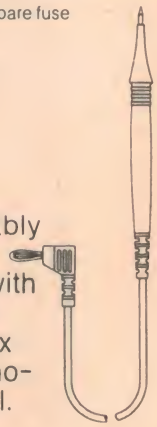

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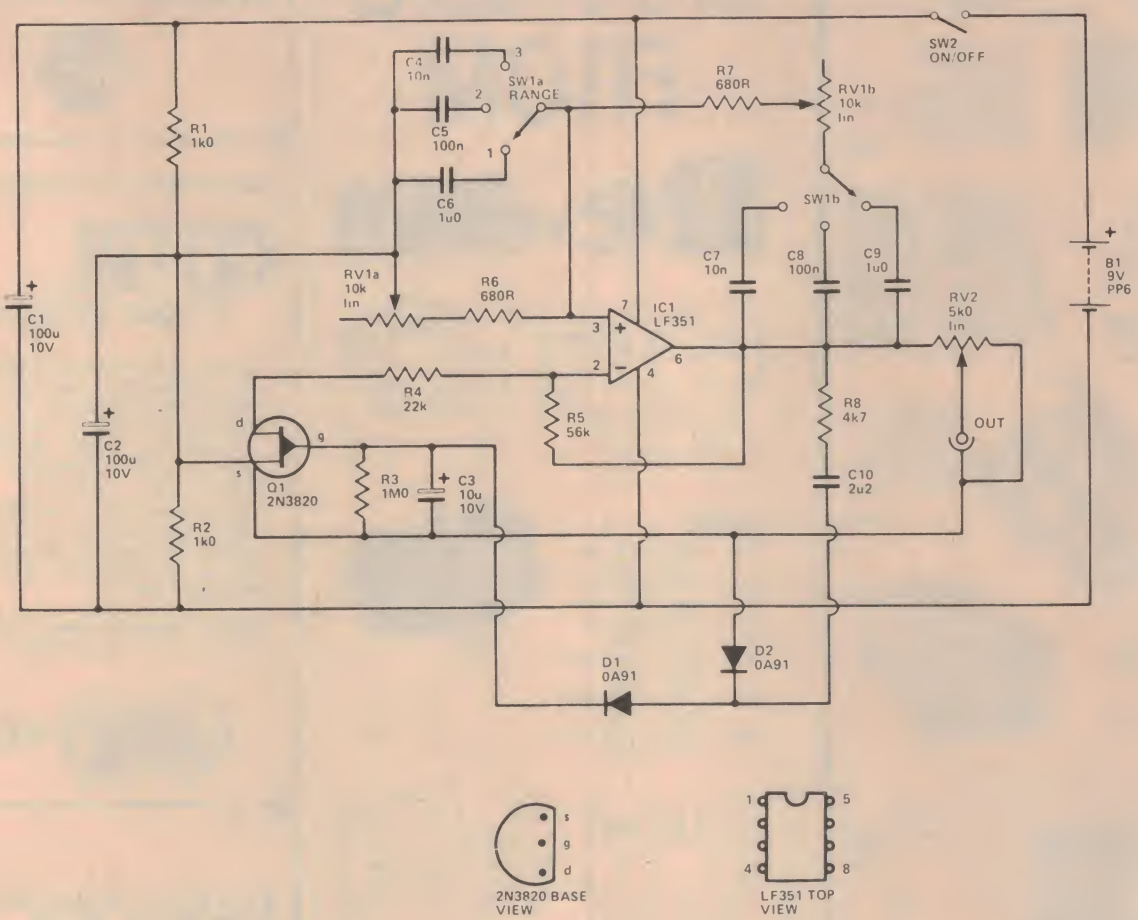


AF signal generator

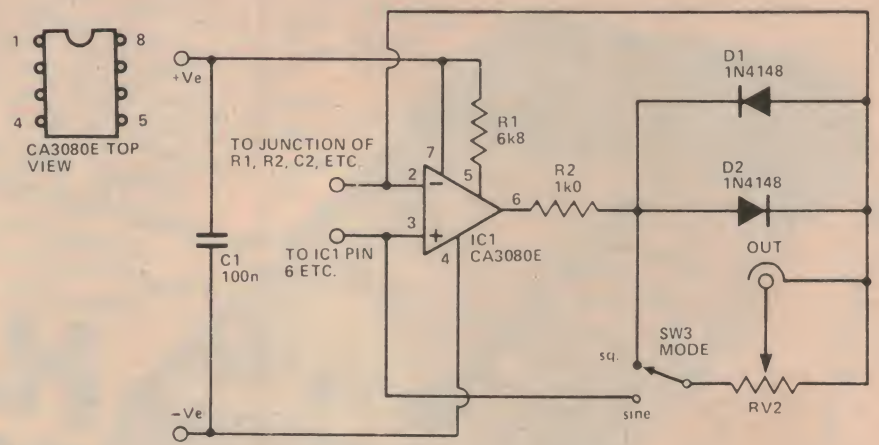
ONE OF the most useful items of test equipment to have, especially if one has an interest in any type of audio gear, is an AF signal generator. The circuit shown here provides a good quality sinewave output over three continuously variable ranges (Range 1, below 20Hz to above 200Hz; Range 2, below 200Hz to over 2kHz; and Range 3, below 2kHz to over 20kHz) covering more than the entire audio frequency spectrum.

The circuit uses the usual Wien Bridge type circuit, and this form of oscillator consists of an amplifier having frequency selective positive feedback provided via a C-R network. The capacitive elements of this network are whichever two capacitors are selected by SW1, the three sets of capacitors giving the unit its three ranges. The resistive elements are R6, R7 and RV1, the latter permitting the unit to be tuned over the ranges quoted above. This network provides positive feedback over operational amplifier IC1, which is a FET type giving low noise and distortion levels. VR1a and R6 also bias the non-inverting input of IC1 to a central tapping on the supply produced by R1, R2 and C2.

The closed loop gain of IC1 must be maintained at precisely the correct level if good results are to be attained. Insufficient gain would lead to less than full compensation for the losses through the C-R Wien network, with insufficient feedback and consequent violent oscillation with the output signal becoming clipped and seriously distorted. An automatic gain control (AGC) circuit is used to maintain stable operating conditions and a constant output level. R5, R4 and the drain to source resistance of Q1 form a negative feedback network which controls the closed loop gain of IC1. Initially Q1 is forward biased by R3 so that there is enough gain to give strong oscillation. Some of the output from IC1 is coupled by R8 and C10 to a rectifier and smoothing network comprised of D1, D2 and C3. These produce a positive bias which tends to cut off Q1, producing reduced circuit gain. The stronger the circuit oscillates, the larger the bias, and the lower the gain becomes. Lack of oscillation produces reduced bias, more gain, and stronger oscillation. The required stabilising action is thus obtained.

Variable attenuator VR2 enables the output to be adjusted from zero up to about 1.5V RMS. The current consumption of the circuit is about 7 mA. ▶

Sine to square converter



THIS CIRCUIT provides an optional squarewave of about 1.2 volts peak to peak when used with the signal generator circuit described on page 57. The above circuit requires no modification, other than the omission of output attenuator potentiometer RV2 which is included in this section of the unit instead.

The squaring circuit is based on operational transconductance amplifier IC1. This device is in some ways similar to an ordinary operational amplifier, but it is the output current rather than the output voltage that is a function of the input voltages. The inverting input of the device is biased to the central tapping on the supply lines, and the non-inverting input is fed with the sinewave output from the main signal generator circuit. When fed with positive going half cycles, the non-inverting input is taken to a higher voltage than the inverting one, resulting in a forward bias being applied to D2 by way of current limiting resistor R2. This produces a positive potential of about 0.6 volts across D2. When the circuit is fed with negative going half cycles the non-inverting input is taken to a lower potential than the inverting one, causing a forward bias to be applied to D1, and producing a negative output potential of about 0.6 volts.

Thus the output is switched from one polarity to the other as the input signal changes polarity, producing the desired squarewave signal. The CA3080E device has a high slew rate (50 V/uS) and is therefore capable of producing a high quality squarewave signal even at the higher frequencies covered by the unit. The gain of the CA3080E can be varied by altering the bias fed to its pin 5, but this feature is of no use in this application and R1 provides a strong bias to the device so that it operates at high gain. SW3 is the mode switch, and merely connects RV2 and the output socket to the output of the sinewave generator or squaring circuit, as required.

The squaring circuitry only adds about 3 mA or so to the current consumption of the unit. ●

SHORT CIRCUITS is a feature that lies somewhere between Ideas for Experimenters and complete Projects. Generally, the items published in Short Circuits will involve tried circuits that have not necessarily been fully developed, but fairly complete details are included as a guide to readers. Unfortunately, owing to the nature of these items, we cannot give further details other than what is provided in the article. Contributions for Short Circuits are always welcome.

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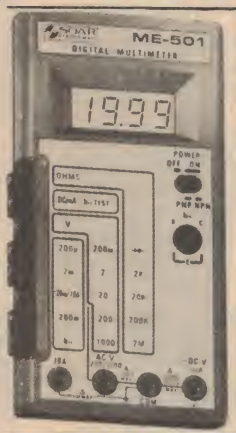

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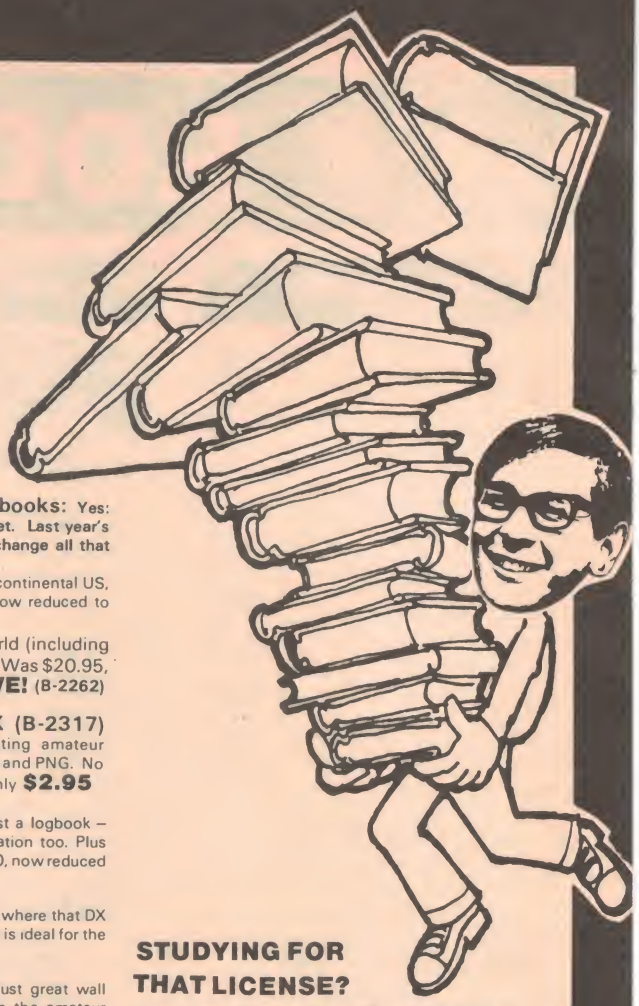

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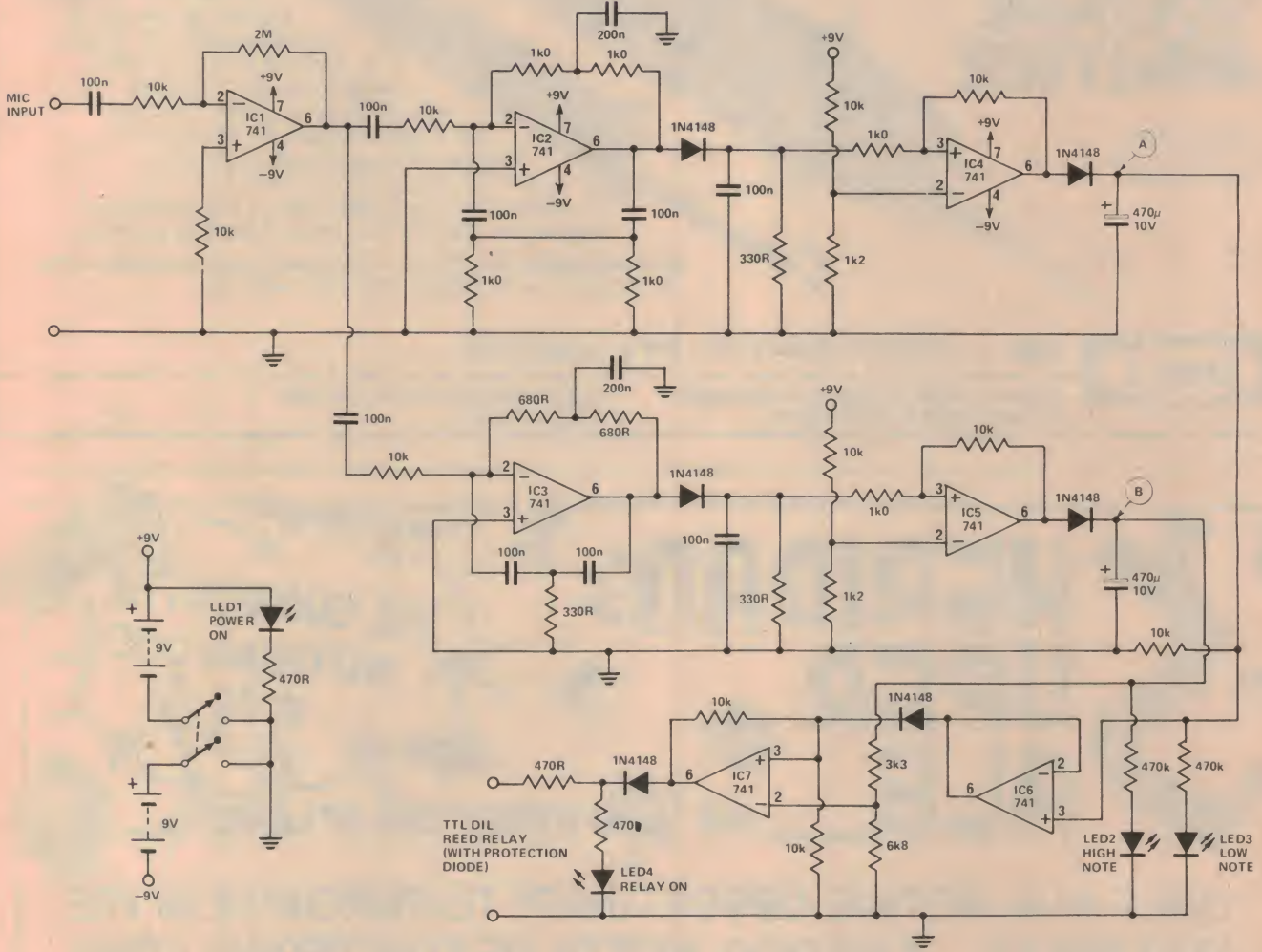
Ideas for Experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.



"Whistle-up" switch

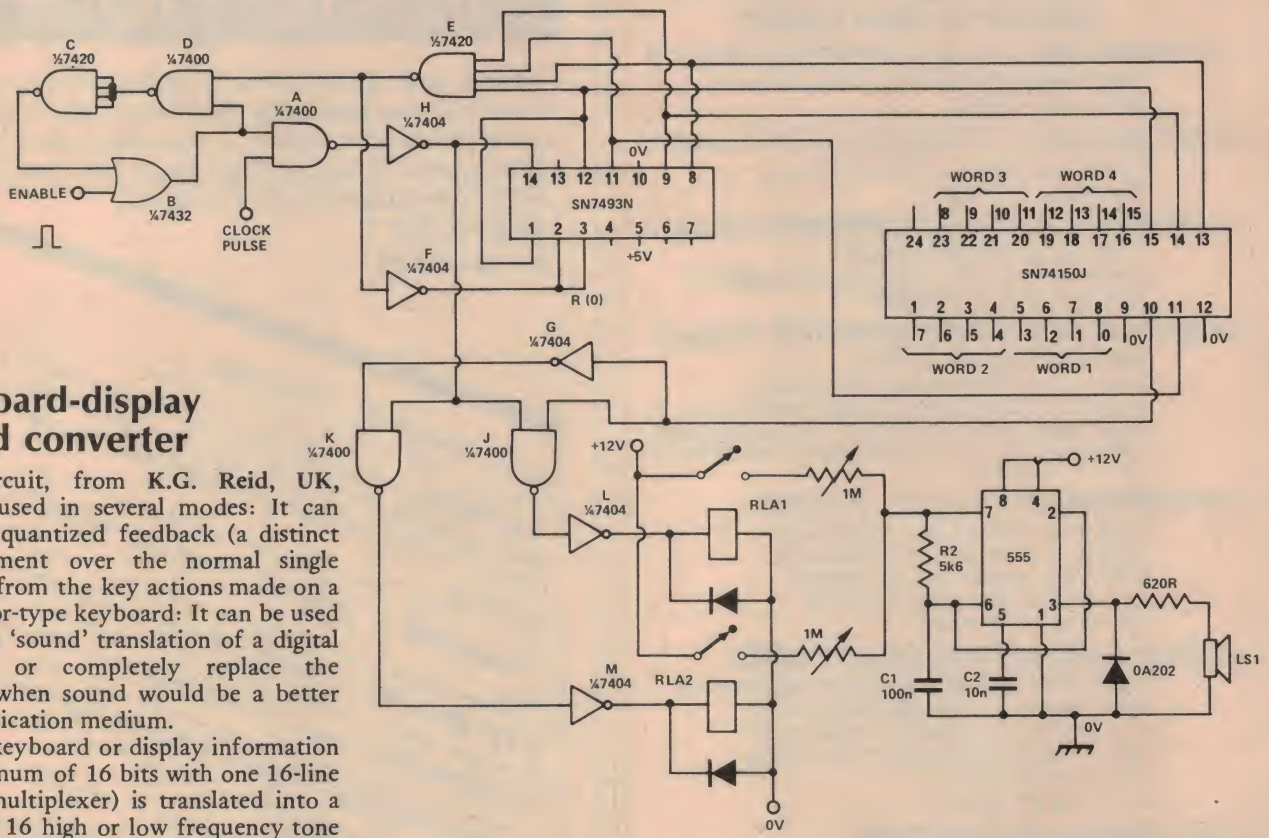
There are many applications – both 'novel' and useful – where one could use a switch that is activated by whistling. This circuit operates a relay when a high-pitched note is whistled, the relay latching on until a low-pitched note is whistled. The circuit comes from **R.C.W. Gate of the UK.**

A concealed microphone picks up the note whistled. The mic output is amplified by a 741 op-amp (IC1), the output of which is filtered by two active peak filters. IC2 is the 'high' note filter and IC3 is the 'low' note filter. The output of each filter is rectified and smoothed then each is passed to the input of a Schmitt trigger – consisting of IC6 and IC7.

The Schmitt trigger is 'set', activating the relay, when the high note is whistled and reset when the low note is whistled, the relay then dropping out.

Points A and B can be used to drive other logic functions. However, if high impedance (i.e: CMOS) logic is used a 10k resistor should be placed across the 470 u capacitor on the outputs of IC4 and IC5.

Ideas for Experimenters



Keyboard-display sound converter

This circuit, from **K.G. Reid, UK,** can be used in several modes: It can provide quantized feedback (a distinct improvement over the normal single 'bleep') from the key actions made on a calculator-type keyboard: It can be used to give a 'sound' translation of a digital display, or completely replace the display when sound would be a better communication medium.

The keyboard or display information (a maximum of 16 bits with one 16-line 74150 multiplexer) is translated into a series of 16 high or low frequency tone pulses, corresponding to the 'high' or 'low' logic state of the 16 bits.

The circuit illustrated was used in conjunction with a digital multimeter, requiring three 4-bit words for the digits and three additional bits for over-range, negative and decimal point. Thus, 15 lines only were required, the 16th being used for resetting.

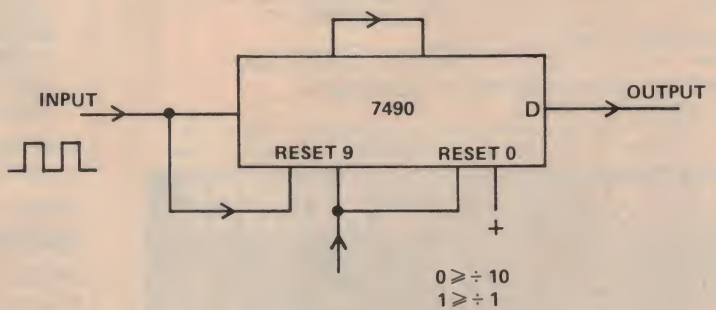
The 15 bits are latched on to the inputs of the 74150 multiplexer. Presentation of the enable pulse results in a logic '1' appearing at the output of gate B, allowing clock pulses to pass via gates A and H to the 7493 counter. Gates B, E, D and C form a latch which remains 'set' until all 15 bits have been sampled. As each bit is sampled, the inverse state appears at the multiplexer output, opening gate J or K and thus operating one of the two reed relays. As a count of 1111 appears from the counter, the output of F drops low, resetting the latch and counter. The operation of either relay results in a tone appearing at the loudspeaker (or earpiece), the tone frquencies being set (1.2 kHz maximum) by the 1 m pots. The tone pulse length is governed by the clock rate.

Simplest 'divide by 1 or 10' scaler

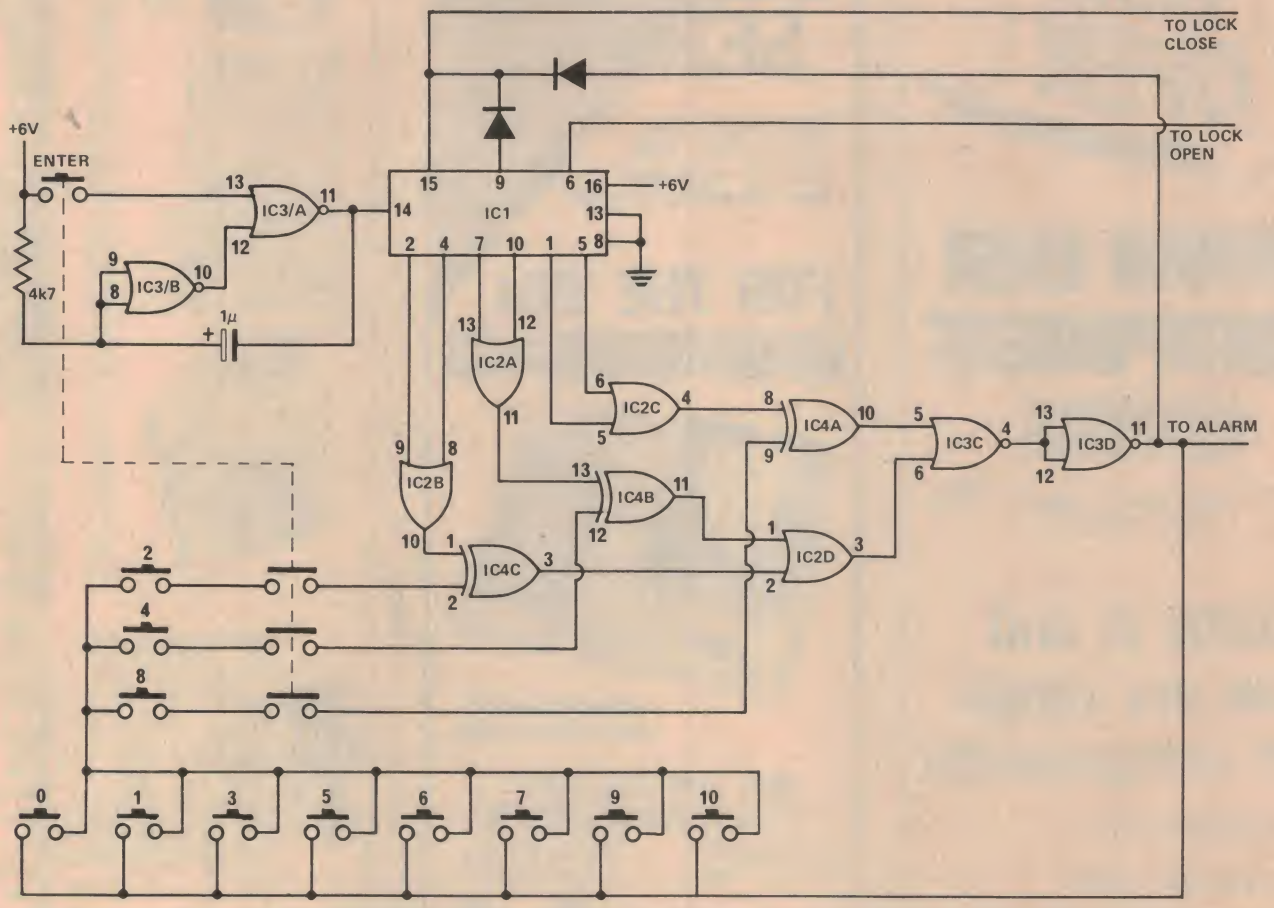
Variable division of clock signals is a nuisance to implement, because of the gating and switching it usually requires. Inspection of the internal circuitry of 7490 indicated an ultimately simple method of scaling.

Reset 9 overrides reset 0 in 7490. Thus if reset 0 is active and reset 9 is cycled, the D output will rise and fall in time with reset 9. When the common reset line is at 0 the counter divides by ten in the normal fashion.

The technique, from **D. Brown of Lindfield NSW,** can be extended to any number of cascaded 7490s.



Ideas for Experimenters



Code lock

This circuit, featuring separate LOCK and ALARM outputs, was sent in by **Michael Saleeba of Croydon in Victoria.**

When the ENTER button is pressed it triggers a monostable, formed by IC3A and IC3B. The output pulse from this monostable goes to the input of IC1, a decimal decade counter. The outputs are safeguarded from shortcircuits by OR gates IC2A, B and C.

The ENTER button also takes outputs from the keyboard. If one of the correct buttons is pressed, logic 1 goes through the ENTER button to IC4A, B or C. This IC is an exclusive-OR gate, so if you press the wrong button a logic 1 will appear on the output of one of the gates. The outputs of these gates are safeguarded by IC2D and IC3C. When you press the wrong button a logic 1 appears on the output of IC3D which goes to the reset and the alarm.

The code number for this circuit is 2,8,4,4,2,8. To operate the code lock you must press this number and then the ENTER button. Then you press the ENTER button one more time for the door to open. To close and reset, press the ENTER button once again.

As the circuit is very versatile, you could get almost any code by extending the code button sequence; e.g: 1,2,3,4, 5,6,7,8,9 or 2,2,2,2,2,2,2,2,2. Another idea would be to have your phone number as a code (although that does present a security risk . . . Ed.).

The ICs are: IC1-4017A, IC2-4071B, IC3-4001A, IC4-4030A. The two diodes may be any small signal silicon diode.

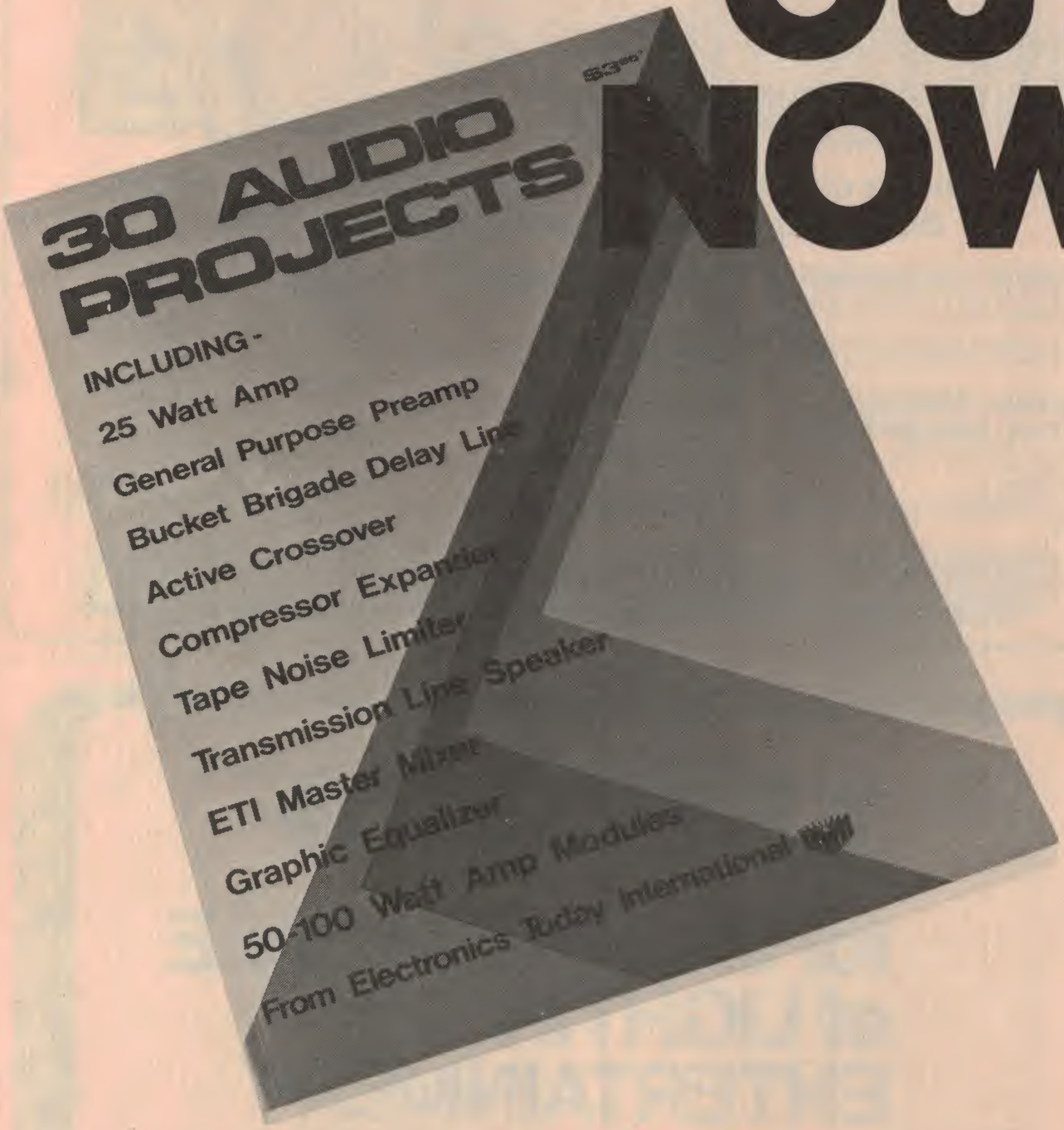
Any ideas?

Have you had a bright idea lately, or discovered an interesting circuit modification? We are always looking for items for these pages so naturally, we'd like to hear from you.

We pay between $5 and $10 per item – depending on how much work we have to do on it before we publish it.

The sort of items we are seeking, and the ones which other readers would like to see, are novel applications of existing devices, new ways of tackling old problems, hints and tips.

OUT NOW



Thirty Audio Projects is the latest in our line of books designed especially with the serious constructor in mind. Ever found yourself leafing through back-issues of ETI for the circuit of a low-noise input stage? Or looking for some information on bucket brigade devices? Or do you need to know that the design you're using has been checked and re-checked for circuit errors and built by people all over the world before it is published? Thirty Audio Projects contains just that — thirty projects of the highest ETI standard, checked and re-checked and then presented in a compact and complete form.

The price is $3.95 — that's under fifteen cents per full project design — and they're *all* audio projects, thirty of our most sought-after designs. Projects include: Simple 25 watt amp; Bucket brigade delay line, Active crossover; Compresser/expander; Tape noise limiter; ETI speaker system; Professional-feature mixer; Howl-round suppressor; the ever-popular 50/100 watt amp modules, Graphic equaliser; Spectrum analyser; Audio millivoltmeter.

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. It also serves to bring new, special or hard to get components to the attention of the reader. If you are looking for a particular component or project from this month's issue – check with our advertisers if it is not mentioned here. Also, for a list of suppliers who stock the ETI projects published over the last few years, our "Kits for Projects" page may generally be found on the pages immediately preceeding the DREGS page (inside the back cover).

With the price of gold rocketing, everybody seems to have forgotten about prospecting for uranium. Perhaps you should take the ETI Geiger Counter along with your ETI-561 Metal Detector on that next prospecting expedition!

Seriously, we expect the ETI-562 Geiger Counter to be very popular with schools, colleges and universities (and maybe people living near Lucas Heights or in Hunters Hill!).

The ZP1310 geiger tube is readily available from Philips Electronic Components and Materials, 67 Mars Rd, Lane Cove NSW, who will sell to the public in one-off quantities. It costs around $30. We expect several suppliers to stock the tube, depending on demand, so check your favourite supplier first.

The ZP1410 geiger tube, which is an end window type sensitive to alpha, beta and gamma emissions, is also available from Philips. At a price close to $80, this tube is quite expensive, so don't expect Philips to have large stocks, which may mean a delay in supply on occasion depending on demand.

We built our unit into a Horwood aluminium case, type 34/10/DS, which is a commonly available item. This case is different from most of the Horwood range of this type as the 'box' section comes with a 'lid', as you can see from the photographs in the article.

The Pipe and Cable Locator is not your 'garden variety' metal detector. It has been designed to have deep penetration and can detect pipes, cables or any metal object at quite considerable depths – depending on size, much as we explained in the metal detector article in last month's issue.

The two cases, with integral antennas, the special handle and the coils for this project are all manufactured by Aegis Pty Ltd, in Victoria. We have arranged with them to supply these hardware components, unassembled, to kit suppliers who wish to market the project. We have already notified kit suppliers of the details in order that supplies might be available by the time you read this.

The 150pF trimmer capacitors specified for this project are commonly available and the pc board has been designed to accept a variety of sizes of different manufacture, so this component should present no difficulties. The actual maximum value is not critical and anything above 100pF will do nicely.

This month's Fuzz/sustain Unit should prove popular with the guitarists amongst our readers – as has the Guitar Practice Amp, featured in the January issue. All the components in the Fuzz/sustain Unit should be readily available, with the possible exception of the NE561 compressor-expandor chip. However, we had no difficulty obtaining these chips from a number of suppliers, so ample stocks should be available.

We built our prototype into a small diecast aluminium case and used remote foot switches. For the latter we used push-on/push-off SPDT switches that are available from electrical wholesalers. Other, more rugged, switches – designed for this sort of application, are available from Jaycar in Sydney, or from Arrow Hart.

Alternatively, the whole unit can be built into a suitable case with the foot switches mounted on top. Some foot switches we have seen have sufficient room inside to mount the electronics.

We have received quite a few enquiries about the 4000/1 Four-way Loudspeaker System published in the February issue. For those seeking suppliers, please refer to the Philips advertisement on page 125 for a list of dealers and distributors who have indicated they will be stocking components and finished enclosures for these systems. Philips distributors in Queensland, South Australia, West Australia and Victoria will be happy to advise you of your nearest dealer.

Eveready have introduced a new range of Extra Heavy Duty batteries. Colour-coded black, they fit between Eveready's gold and red series so that the battery line-up is now: Silver - general purpose, Red - heavy duty, Black - extra heavy duty and Gold - alkaline long life cells. This new range will be launched with a heavy TV and magazine advertising campaign.

PRICE ESTIMATES

The price estimates given here are only to be taken as a guide. You may expect some variation, depending on pricing from sources. With regard to the Pipe and Cable Locator we were only able to obtain approximate prices for the hardware as we went to press and our estimate may be in error by as much as 20%, though we hope we have erred on the high side. In general, typical retail prices of components have been used to calculate the project costs.

ETI-562 Geiger Counter
(with ZP1310 tube) $55 - $65
(with ZP1410 tube) $100 - $110

ETI-566 Pipe & Cable Locator
(less hardware) $45 - $50
(with hardware) $120 - $130

ETI-453 General Purpose Amp Module
as described $9 - $11

ETI-454 Fuzz/sustain Unit
(less switches) $22 - $28

Buy Direct
From the INDEPENDENT IMPORTER

PERSONAL COMPUTERS

CIP: $459 A dramatic breakthrough in price and performance. Features OSI's ultra-fast BASIC-in-ROM, full graphics display capability, and large library of software on cassette and disk, including entertainment programs, personal finance, small business, and home appliances. It's a complete programmable computer system ready to go. Just plug-in a video monitor or TV through an RF converter, and be up and running. 15K total memory including 8K BASIC and 4K RAM – expandable to 8K.

CIP MF: $1657 First floppy disk based computer for under $1700! Same great features as the CIP plus more memory and instant program and data retrieval. Can be expanded to 32K static RAM and a second mini-floppy. It also supports a printer, modem, real time clock, and AC remote interface, as well as OS-65D V3.0 development disk operating system.

PROFESSIONAL PORTABLES

C4P: $849 The professional portable that has over three times the display capability of CIPs. Features 32 x 64 character display in up to 16 *colors,* graphics, audio output, a DAC for voice and music generation, key pad and joystick interfaces, AC remote control interface and much more. Utilizes a 4-slot BUS (2 used in base machine), 8K BASIC-in-ROM, 8K of *static* RAM and audio cassette interface. Can be directly expanded to 32K static RAM and two mini-floppy disks.

C4P MF: $1999 The ultimate portable computer has all the features of the C4P plus real time clock, home security system interface, modem interface, printer interface, 16 parallel lines and an accessory BUS. The standard machine operates at twice the speed of currently available personal computers (with GT option it runs even faster!) The C4P MF starts with 24K RAM and a single mini-floppy and can be directly expanded to 48K and two mini-floppies. Available software includes games, personal, business, educational and home control applications programs as well as a real time operating system, word processor and a data base management system.

HOME/SMALL BUSINESS SYSTEMS

C8P: $1099 Same great features as the C4P in a tremendously expandable "mainframe package." Features over three times the expansion capability of the C4P for advanced home and demanding business applications. Can be expanded to 48K RAM, dual 8" floppies, hard (Winchester) disks and multiple I/O devices such as Voice I/O and a universal telephone interface.

C8P DF: From $3149 The ultimate Home/Very Small Business Computer at a personal computer price. Features 32K RAM (expandable to 48K) and dual 8" floppy disks (stores eight times as much information as a mini-floppy). Has all personal computer capabilities including 32 x 64 display, color graphics, sound, DAC, joystick interfaces, home features including real time clock, AC remote interface, home security and fire detection interface and can be expanded to include voice I/O and a universal telephone system for answering and initiating calls! Its large memory capability and 8" floppies allow it to run most Ohio Scientific business system software including a complete accounting system, word processor and information management system.

OHIO SCIENTIFIC

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ALL OHIO SCIENTIFIC INTERNATIONAL MODELS AVAILABLE FROM SUPERBOARD TO HARD DISK

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Print-out

1980 Home Computer Shows for Sydney and Melbourne

The burgeoning personal computer, microprocessor and small business systems market will be highlighted by the staging of the 1980 Home Computer Shows in Sydney and Melbourne.

The Sydney Home Computer Show will be held at the Westco Pavilion, Sydney Showgrounds on May 22, 23, 24 and 25. The Melbourne Home Computer Show will be held at the Kew Civic centre on September 11, 12, 13 and 14.

The three previous annual Shows — two in Melbourne and one in Sydney, attracted a combined total of more than 40 000 people and over 130 companies and exhibitors displayed their products.

According to newly-appointed 1980 Home Computer Show director, John Kennedy, the two shows planned for this year will capitalise on the interest generated by the previous Shows and will reveal the rising maturity of the microcomputer industry in Australia.

"The 1980 Home Computer Show apart from reflecting the current status of microcomputer equipment and technology will also offer a valuable insight into future directions.

"The 1980 Show will coincide also with the expansion of the educational market as secondary and tertiary institutions plan their immediate purchases of equipment. We will also recognize that the micro-computer area is a stepping-stone for many young people preparing for careers as computer professionals," he said.

Applications are now open for display stands at the Sydney Home Computer Show, applications for the Melbourne event will open in July.

An exhibitors prospectus is available on request from the 1980 Home Computer Show, 443 Little Collins Street, Melbourne 3000, phone (03) 67-1377 or in Sydney (02) 918-8174.

The PET grows up

Recently, Hanimex released a more powerful and sophisticated version of the Commodore PET personal computer, namely the Commodore business system 3000 series.

The CBM 3000 consists of a 32K CPU complete with a 1000 character display, keyboard, a twin floppy disk drive with 340K byte user capacity and a 70 line per minute dot matrix printer.

Small business programs developed for the CBM 3000 include creditors/general ledger, debtors, and stock control. Other programs developed for specific markets include a pharmacy dispensing program, a package for dentists and a poker machine analysis programme for clubs.

Most CBM systems can be installed for under $10 000 and will lease for about $270 per month.

For further information contact Mr N. Shepherd at Hanimex Pty Ltd (02) 938-0275.

New peripherals from Texas

Five new peripherals for the TI-99/4 home computer have recently been marketed by Texas Instruments.

These peripherals have been designed to expand the capabilities of the TI-99/4 computer and include a mini-floppy disk system, RS-232 interface, acoustic modem, speech synthesis module and a thermal printer.

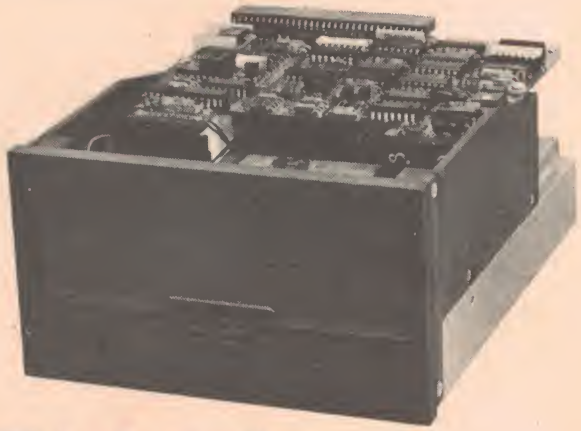
It is expected that these peripherals will be available in the first half of this year and further information can be obtained from Texas Instruments direct.

Office Data Products

Computer Supplies Australia Ltd has been appointed Australian distributor for all Office Data Products (ODP) brands.

Items include floppies, cassettes, data cartridges, as well as magnetic cards at highly competitive prices and most customers should have their requirements available on a same-day basis. Computer Supplies offer a two hour delivery service in the Sydney city area.

For further information and prices contact Computer Supplies (Australia) Pty Ltd P.O. Box 226 Crows Nest NSW 2065 (02) 439-5533.



MPI in Australia

Zero One Electronics of Brisbane has been appointed Australian OEM distributors for Micro Peripherals Inc., of Chatsworth California.

They will be handling three models of mini-floppy drive units featuring pulley-band head drive for fast access and the unique front door diskette eject mechanism. Further information can be obtained direct from Zero One Electronics, 200 Moggill Rd, Taringa 4068. (07) 371-6707.

Portable data commtester for field service

The proliferation and increasing complexity of data communications networks coupled with the soaring cost of network downtime have created a demand for test instrumentation that can quickly pinpoint the faulty element in a down network.

The new Tektronix 833 Data Comm Tester weighs only 5.5 kg and is completely self-contained in a compact, rugged carrying case. Its "friendly" design is aimed at meeting first line service technicians ease-of-use requirements, according to TI.

The 833 efficiently isolates the equipment that is malfunctioning in a network by simulating the data communications equipment (DCE) to verify correct operation of the terminals or CPU, or by performing standard BERT/BLERT tests on the entire transmission link to verify correct operation of the modems or phone line.

The 833 can be set to match the parameters of virtually any data communications system with data rates up to 9600 baud, including half or full duplex, synchronous or asychronous. The RS232/CCITT V.24 interface assures nearly universal applicability and an adapter enables users to perform current loop tests.

The 833 performs the standard bit error rate test (BERT)/block error rate test (BLERT) on the data link and calculates error detection codes for confirming accuracy of data in the network. Monitoring HDLC/NRZ1 protocols allows use of the 833 in the latest sophisticated data communications networks.

In addition to standard stored test messages which can be called up without time consuming hand entry, a customised user PROM permits storage of product-specific test messages for use by service technicians without need of costly mass storage devices. This full message is callable using only four keystrokes.

The user can program the 833 to initiate transmission of the stored messages upon receipt of specified data sequences. Additionally, trigger positioning permits selective analysis of data before, in the middle and after the trigger sequence.

Further information from Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde, NSW 2113.

Double-sided floppies by Data Systems

A new double-sided flexible disk memory system, compatible with all DEC and IBM diskette formats, was introduced by Anderson Digital Equipment Pty Ltd, agents for Data Systems Design.

The DSD 480 system reads and writes on both sides of industry standard 8-inch (205 mm) diskettes for a formatted capacity of one megabyte per diskette, or two megabytes of on-line storage.

The system which is hardware, software, and media compatible with DEC LSI-11 and PDP-11 computers, doubles the capacity of other DEC compatible flexible disk systems and allows DSD 480 users to conveniently transfer data and programs between DEC and IBM computers.

The DSD 480 is packaged in a low profile (133 mm) chassis for rack mounting or tabletop operation.

Simple operation and complete documentation facilitate system integration. It is priced at $4964, and further information can be obtained from Anderson Digital Equipment Pty Ltd, P.O. Box 322, Mt Waverley Vic 3149 (03) 543-2077.

Brief bytes

EMI are to manufacture Raytheon terminals in Australia. Initially, EMI will assemble componentry and undertake final assembly testing of the terminals against Raytheon specifications at EMI's South Australian plant. It is anticipated that EMI may become involved in such areas as software enhancements and systems evolution, particularly network management. Enlarged ability for systems maintenance is an expected advantage of gaining production facilities.

Mostek are to second-source Zilog's Z-80 CPU, despite the booming popularity in 16-bit processors. They see plenty of long-term market potential in 8-bit devices. Mostek are expected to release a high performance version of the Z-80 around mid-year believed to be capable of a 5 MHz to 6 MHz clock rate.

This business is getting rather incestuous, what with everybody second-sourcing everybody else. Latest Chinese chip copy is Intel's version of Nippon Electric's quad floppy disk controller chip, the uPD765. Intel's 8272 is a 40-pin package device that supports double-sided, double-density formats. It is pin- and functionally compatible with the Nippon chip. The 8277 uses HMOS and clocks along at 8 MHz. As the Nippon Electric chip is scarcer than hens' teeth, this is welcome news.

A disk operating system for the Z8000 has been announced by Hemenway Associates in the US. The HA-CP/Z8000 needs less than 8K of memory, according to our source, provides interface to Winchester and floppy disks, combines memory-resident and transient commands and transfers data between devices via its Peripheral Interchange Program.

A new computer-output-to-microfilm (COM) system combining the power of a minicomputer preprocessor with 64K words of memory plus other features has been introduced by the COM Products Division of Bell & Howell. The package is claimed to embody new sophisticated software and a variety of interfacing and peripheral options to offer users unparalleled throughput and ease of operation. Designated the 3900 COM system, the new unit includes in its basic configuration a PDP-11/34 16-bit minicomputer, a CRT terminal, a keyboard operator console, a pair of floppy disk drives for system software and setup data, and a COM recorder. In addition, a 6250 BPI tape drive, a 5.2 megabyte disk drive, a line printer, an IBM 360/370 interface and a dry film COM recorder are available as options. More info available through Bell and Howell offices in all states.

Printout

Complex sound generator family from Texas

Three new complex sound generation ICs have been announced by Texas Instruments.

Two of the circuits are complex sound generators that can be used separately or with a microprocessor-based system. The third circuit is a sound generation controller designed to provide low-cost, programmable tone and noise generation capability for microcomputer systems. The SN76487N and SN76488N use integrated injection logic which allows both logic functions and linear audio circuity to be combined on the same chip.

Noise, tone, low-frequency sounds or a mix of these three can be created to serve a wide range of user-defined requirements in arcade or home video games, toys, timers, alarms, industrial annunciator circuits or feedback controls. Both new circuits feature on-board audio amplifiers which can drive an 8 ohm speaker with approximately 100 mW of audio power.

The SN76487N is a low-cost version of the popular SN76477N, introduced in early 1978. Available in a 16-pin package, the SN76487N is designed for high-volume, low-cost applications not requiring the outputs and controls offered by the SN76477N or SN76488N. The SN76488N comes in a 28-pin package with direct pinouts from the Super Low Frequency (SLF) oscillator, the Voltage Controlled Oscillator (VCO) and the one-shot circuit which gives the designer added design flexibility. The addition of a multiplexer enables the SN76487N to produce simultaneous sounds, such as musical chords. The SN76488N, however, does not require a multiplexer since it has an internal clock.

Both the SN76487N and SN76488N are TTL and MOS compatible so that they can be used with microprocessor-based systems or can act as stand-alone devices.

Two of the three new sound generation circuits are ready for immediate delivery through authorized TI distributors and are priced in 100-piece quantities at: US $1.69 for the SN76487N, US $2.78 for the SN76488N.

New S100 products

AED has developed two new S-100 products for the Australian market.

One is a multi-purpose I/O card which features an 8255 programmable peripheral interface, an 8295 programmable interrupt controller, a 60 Hz clock, a keyboard port with status latch, a digital-to-analog converter and a port to implement address bus expansion.

The board is designed to comply with the new IEEE S-100 standard and is available as either a bare board with manual or as a kit with various options as required.

The other is an S-100 card implementing an 8255 port for general purpose I/O. This is also available as a complete kit or as a bare board with manual.

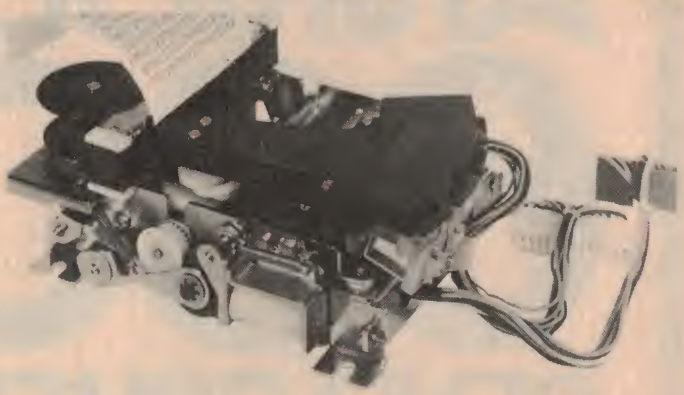
Further information and prices can be obtained from Acoustic Electronic Developments Pty Ltd, 123 Military Rd, Guildford NSW 2161. (02) 632-6301.

W.A. Club

The West Australian Computer Enthusiasts Group held their annual elections at the Club's AGM on 29 January last.

Elected were: Neil Stocker, President; Lew Roeger, Secretary and Bob Langlois, treasurer. Meetings are held on the last Monday of each month except when that day coincides with a public holiday, in which case the meeting is held on the following Tuesday. Venue is the premises of Taimac Corporation, 1st floor, Cnr Newcastle and William Sts, Perth. Meetings start at 7.30 pm.

If you are interested in finding out about the Club's activities, contact: The Secretary, L.H. Roeger, 59 Lansdowne Road, South Perth. (09) 367-2149.



Miniature dot matrix impact print mechanism

The London Office of the Star Mfg Co Ltd has announced the release of a new miniature matrix printer.

Their latest print mechanism, the model DP-822 is low in cost and is a 21 character dot matrix impact device.

The heart of the DP-822 is a mobile head consisting of seven vertical needles, which are used to build up characters on a 7 x 5 dot matrix. The minimum life of this head is 15 million characters and features both simple replacement and adjustment, according to Star.

Working at a speed of about 580 Hz a printing speed of 2.5 lines per second is achieved, including feeding the paper forward by one line space during the head return time. Character height is 2.9 mm.

Standard 58 mm wide paper is used, the inking medium being by easily replaceable ink ribbon. The high impact force of the DP-822 head allows a high quality copy to be obtained when two-ply carbonless paper is used.

For microprocessor connection a complete interface or the controller chip alone can be supplied.

The physical size is 106 mm wide, 145 mm long and 52.5 mm high with a weight of 570 grams. The unit operates completely from a 12 Vdc supply.

Help for single-drive CP/M users

Acoustic Electronic Developments are agents for a package of CP/M utilities specifically written to help users of single drive CP/M.

The programs are back-up, copy, restore and SDD. AED believes that this package will save the user many hours of heartbreak.

Prices and further information can be obtained from Acoustic Electronic Developments Pty Ltd, 123 Military Rd, Guildford, NSW 2161. (02) 632-6301.

Military 2716

A new version of the 2716 EPROM for operation over the full military temperature range is now available from National Semiconductor Corporation.

It is designated the MM2716M and is priced at $123.19 in lots of 100.

For further information contact N.S. Electronics P.O. Box 89 Bayswater Vic 3153.

Graphic terminal

A new graphic terminal has appeared on the market.

The Princeton 8500M raster graphics terminal is claimed to offer an unprecedented combination of features and benefits presently unavailable even in higher priced systems.

For further details and prices contact The Dindima Group Pty Ltd, P.O. Box 106 Vermont Vic 3133.

ANNOUNCING 68000 DEVELOPMENT SYSTEMS

The EXORmacs Development System for 68000 has just been announced. The system includes 15 slot chassis and power supply, MPU module, memory management module, deBUG module, 128K byte dynamic memory module, and an intelligent floppy disk controller module.

Software includes Structured Macro Assembler/Linkage Editor, screen based editor, symbolic deBUG and a PASCAL compiler.

Peripherals include intelligent CRT console, a 1 Mbyte, two drive double sided floppy disk, and a model 703 (180 CPS 132 column) line printer.

A large number of support modules are also available.

6800/6809 EXORciser Development Systems

The popular EXORciser II Development System is now available in both 6800 and 6809 versions. For those people already owning a 6800 EXORciser or EXORterm Development System, a 6809 upgrade kit is available. Both EXORcisers may be expanded to allow development of the

MC6802/MC6808
MC6801/MC6803/MC68701 MC6805

A wide range of support modules are available, including support modules for PIA, ACIA, SSDA, ADLC, GPIA, CRT controller and universal support module.

High level languages are available for —
6800: BASIC, FORTRAN, COBOL, MPL.
6809: FORTRAN, MPL, PASCAL.

Bulk storage is available on both single and double sided floppy disks. Up to 4 drives are supported.

A 10 Mbyte Hard Disk System is also available with expansion to 40 Mbyte. The Hard Disk System may co-reside with the floppy system to allow easy transfer of old files.

68000 Courses

Rank Electronics has much pleasure in announcing a visit from two leading Motorola lecturers to give courses on the MC68000.

Subjects will include both hardware and software aspects.

Course costs: $250.00 per head for each course.

Dates: Sydney — May 19, 20, 21 and 22.
Brisbane — May 23, 26 and 27.
Adelaide — May 28, 29 and 30.
Melbourne — June 2, 3, 4 and 5.

Hours: Sydney and Melbourne — 9.00 a.m. to 5.00 p.m.
Brisbane and Adelaide — 8.30 a.m. to 7.30 p.m.

For further details and application form please contact:

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MAS5561

Printout

TRS-80 gets full-size floppies

The real power of a small computer is not so much in the speed or extended instruction set of its CPU as in the speed and capacity of its mass storage and the capability of its VDU interface.

An 80 x 24 memory-mapped VDU with lower case, for example, can present information much better than a serial-linked 32 x 16 with upper case only.

This is where full-size floppies have it all over mini-floppies. The 203 mm floppy (that's the Australian metricated equivalent of the US-style 8-inch floppy) offers about double the capacity of the 133 mm floppy (sorry about this, but metric units are required by law) and runs considerably faster. The speed factor is not significant for most personal computing applications but the greater capacity of the 203 mm disk makes a heck of a difference.

For example, the well-known CP/M operating system was designed for full-size floppies and the version which is available for 5" (oops, sorry, I meant 133 mm) disks runs like a lame dog in comparison. CP/M is an important piece of software for most disk-owning computer buffs, because a lot of software is available to run under it, so that it has provided a de facto standard for software exchange.

The major problem with the TRS-80 has been its inability to run CP/M because CP/M lives at the bottom of memory, where Radio Shack have thoughtfully placed a great lump of ROM. There is a non-standard version of CP/M around which lives higher up in memory, but this will not run the bulk of the nice CP/M-compatible software which is available.

This is why a company called Parasitic Engineering (1201 10th St., Berkeley, CA 94710, USA) has done the TRS-80 community a great service with their latest two products. The first is a 203 mm floppy drive with controller and patches to TRS-DOS, called the Maxi-Disk. With this alone, it is possible to run TRS-DOS on both 203 mm and 133 mm disks, mixed together if need be — the controller allows both disk sizes at the same time.

The second, more significant, offering is called the Shuffleboard. This board plugs into the Z-80 socket and moves the ROM in the TRS-80 from the bottom of memory up near the top, and brings the RAM down, through some judicious tinkering with the address lines. This will allow the TRS-80 to run a proper CP/M without modification or reassembly of programs — probably the most worthwhile innovation yet for the TRS-80. When will somebody do a modification for the VDU circuitry?

With upper and lower case, the Radio Shack machine would be a very nice system indeed.

The Maxi-Disk is priced at US $995, and the Shuffleboard, complete with CP/M on an 8" (damn, I meant 203 mm) disk, is $245.

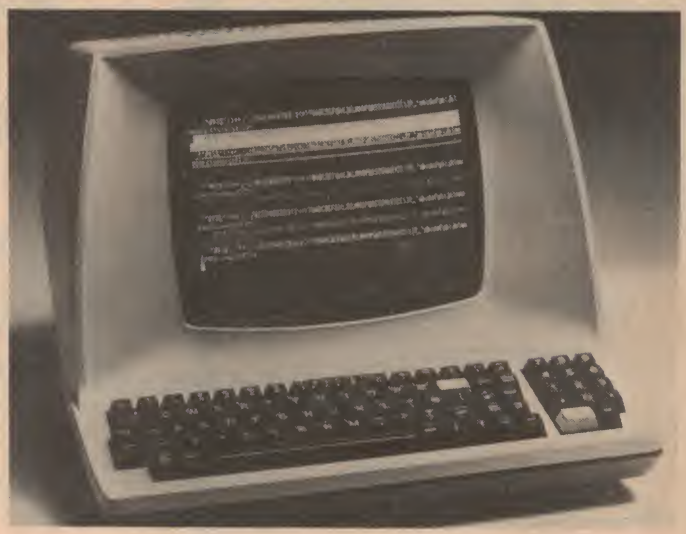
Parasitic don't seem to have a representative or agent in Australia, but it can only be a matter of time before some enterprising company grasps this opportunity — provided they can overcome the problem of converting 8" disks to 203 mm to suit Australian conditions, that is!

Hard Copy of DEC

A new version of the desktop 4632 video hard copy unit, known as the 4632 Option 8, has been introduced by Tektronix.

It has been specially c esigned for providing high resolution paper hard copies from DEC MINC systems: the MiniMINC and the VT105-based DECLAB-11/MNC.

The 4632 Option 8 can copy both alphanumerics and graphics simultaneously. Further information and prices can be obtained from Tektronix 80 Waterloo Rd North Ryde NSW 2113. (02) 888-7066.



Televideo VDUs

Anderson Digital Equipment have been appointed distributors for the Televideo range of visual display terminals.

The Televideo TV1 912 is an ADM-31 compatible unit with editing capabilities and many features come as standard. Examples are dual intensity, addressable cursor, programmed underline, reverse video, blinking, switch selectable conversation or block mode transmission with 10 baud rates from 75 to 19000 baud.

The unit is microprocessor controlled with the ability to insert or delete characters or lines. The screen provides 24 lines by 80 characters with a 12 x 10 character resolution.

A second page of memory and a printer port are optional.

Normally priced at $1295, ADE are selling their first shipment at $895, when purchased in groups of six.

Further information can be obtained from Anderson Digital Equipment Pty Ltd, P.O. Box 322, Mt Waverley Vic 3149 (03) 543-2077.

The Challenger 4

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You'd have to go a long way to get better value in a computer. It has execution speed that really separates the computers from the toys. We think the Challenger 4 is way ahead of anything you've seen so far, for a wide variety of uses including business, personal, educational and games, as well as a real-time operating system, word processor and a data base management system.

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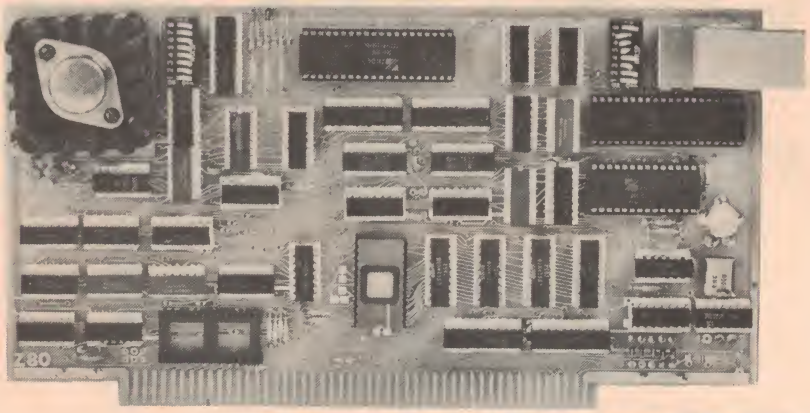
ROBOTS: HOME COMPUTERS



Described in ETI starting November 1979 the DGZ80 is totally Australian designed and supported and represents a world scoop for ETI. Built around the powerful Z80 chipset (CPU, P10, CTC) the DGZ80 is a complete computer on one board and as such can be used as a freestanding controller or as part of a complete micrcomputer system. Articles soon to be published in ETI will describe a series of experiments using the DGZ80 as a robot/controller which will stimulate considerable interest in this new technology.

Z80 / S100 = TOTAL FLEXIBILITY . . .

EXPERIMENT WITH Z80 ROBOTICS — CONTROLLERS

Now is the time to start experimenting with ROBOTICS AND MICROPROCESSOR CONTROLLERS. The ETI/DGZ80 is ideally suited as it features:

- 8 dedicated INPUT channels.
- 16 dedicated OUTPUT channels.
- 4 programmable TIME channels.
- On board 1K RAM (expandable to 2K).
- Provision for on board ROM (System Monitor).
- POWER ON JUMP facility.
- S100 Bus for system expansion.

We have designed a low cost experimenter's kit which when connected to the DGZ80 enables you to connect various input stimulii such as switches, photocells, thermistors, microphones and produce various output functions into motors, relays, LEDS and loudspeakers.
The control software is provided in the MATTLOC monitor ROM and the manual enables you to program your DGZ80 to play music output answers onto LEDS, control relays, build a burglar alarm etc. With external S100 boards speech synthesis and recognition is already possible and we hope to produce a super low cost speech unit later this year.

DGZ80 Robot Kit

DGZ80 1K RAM, MATTLOC monitor, I/O experimenters board with full manuals, **$249.50** tax paid, $222.60 tax exempt.

For owners of DGZ80 Robot/Controller option

MATTLOC monitor, I/O experimenters board with manuals, **$89.50** tax paid, $79.40 tax exempt.

Z80 BUDGET HOME COMPUTER ON S100.

Build your own Z80 based home computer using the ETI/DGZ80 described ETI November 1979. Designed by David Griffiths, this is probably the most powerful S100 Z80 project described in the world to date. Features include on board P10 (dual 8 bit I/O) CTC (4 channel programmable counter (timer), power on jump, software write protect option, provision for 2K ROM on board, 1K RAM for stack, scratchpad (expandable to 2K) top quality solder masked, plated through PCB and comprehensive owners manual.

DGZ80: Kit **$199.25** tax paid, $175.00 tax exempt.
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DGOS Monitor ROM 2716: Optional but strongly recommended, $48.00.

DG640 — S100 VDU

Described in ETI March 1978 the DG640 features 16 lines of 64 characters, upper and lower case with graphics, crystal locked self-contained TV scan circuits, top quality plated through PCB sockets for all IC's and comprehensive owner's manual.

DG640: Kit **$139.50** tax paid, $125.70 tax exempt.
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TCT 16K (2114) S100 RAM

The TCT 16K is an Australian designed and supported static RAM card on the S100 bus. Features include 4 independently addressable 4K blocks each with write protect and disable. In addition the board has bank select and phantom capability. Directly compatible with DG Z80, DG 640 the TCT 16K use a top quality plated through, solder masked PCB with comprehensive owners manual. Sockets included for all IC's.

TCT 16K: Kit less RAMS **$100.00** tax paid, $95.00 tax exempt.

PCB's WITH MANUALS

DGZ80 CPU $45.00.
DG640 VDU $35.00.
TCT 16K RAM $45.00.

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S100 Protoboard (flow soldered) $19.75.
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SECI Cassette Interface $24.50.
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STOP PRESS: See magazines for details of S100 TCT PCG (Programmable Character Generator plus Joystick for DG640), and also MICROWORLD — Z80 BASIC ON TAPE for the DGZ80.

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The Vector MZ

Les Bell

Vector Graphic Inc., of Westlake Village in California, is one of those microcomputer companies who don't make loud noises about their products but quietly turn out quality machines that people nonetheless get to hear about.

The basic Vector MZ System B consists of the computer (based on the S-100 bus) with twin minifloppies – at left – plus the MT 'mindless terminal', right. Up to five terminals may be hooked up to the one machine and the system sports time-sharing facilities.

THE VECTOR MZ is a complete system based on the Z-80 CPU and a pair of Micropolis minifloppy drives. Thanks to Vector Graphic's Australian agents, A.J. & J.W. Dicker, I was recently able to gain first hand experience of the MZ and its companion terminal, the MT.

Vector Graphic started out about three years ago as a supplier of memory boards for the S-100 bus, and went on to develop video cards, processor cards, disk interfaces and eventually complete systems based on their cards.

The Vector systems are aimed primarily at small business users – the hobbyist market is not large enough to support many companies, as some are finding out to their cost. Two systems are available – the System B, which is a small business system for accounting/stock control applications and the Memorite, a word processor. Both systems are capable of carrying out both functions, as they are based on the same hardware, but the Memorite has the word processing software permanently stored in ROMs.

The MZ

Based on the S-100 bus, the MZ computer system utilises most of the Vector Graphic range of cards.

The MZ mainframe is an 18-slot motherboard with +8 V at 18 A, ±16 V at 4 A power supply, mounted in an attractive cabinet. Twin minifloppies are mounted at the right side of the enclosure, beside the card cage.

The processor in the MZ is a Z-80A running at 2 MHz or 4 MHz (jumper selectable), and will operate in all three of the Z-80 interrupt modes. A 48 Kbyte memory card provides the system's random access memory, while a PROM board contains up to 12 Kbytes of PROM or EPROM.

The Micro-Stor disk interface provides over 315 Kbytes of storage on each of two Micropolis 5 inch (133 mm) disks. The disks are hard sectored, and offer data transfer rates up to 250 Kbits/s. The Bitstreamer I/O board carries one serial and two parallel ports, which are used for interfaces to printers, etc.

The console I/O in System B is through the Mindless Terminal, which is basically a keyboard and monitor in a single case – the VDU electronics is actually in the MZ computer, giving all the advantages of a memory-mapped VDU in what at first sight appears to be a serial terminal, and allowing complex on-screen editing.

From the user's side

The System B is supplied completely assembled and tested, and all its components are known to work together – since they all come from the same source and were designed to work together, it would be strange if they didn't. Bearing this in ▶

mind, it is probably more constructive to consider the system from the user's point of view, which is primarily dependent on the software and the way it interfaces to the hardware.

The combination of the Mindless Terminal and the Flashwriter II VDU board provides a high quality display in an 80 column by 24 lines format. For many hobbyists an 80 x 24 display may seem like a bit of a luxury, but its convenience can make some tricky editing jobs a whole lot easier, and for commercial work, an 80 column display is just about essential. Because the MT contains a high quality monitor (900 line resolution at centre, and 750 line at the borders), and the Flashwriter II supplies it with separate TTL video and sync, the character definition is excellent, and there is no 'wobble' as is sometimes seen on less expensive VDU/monitor combinations.

There are only two controls on the front of the MZ computer; a keyswitch for power, and a reset pushbutton. There is no front panel, so the operator (who is usually inexperienced in a typical small business) can't foul things up by accidentally flicking a switch at the wrong time. Nobody uses front panels any more, anyway (except me, and I even have the bad taste to count in octal!).

All the user interaction with the system is therefore through the terminal and the system software, from the monitor program up through the Disk Operating System. The Vector Graphic Extended Systems Monitor is stored in PROM, and is immediately available on power-up. However, most users will hardly come into contact with the monitor, but will simply use its command to call in the full Disk Operating System.

The operating system supplied with the system is the Micropolis DOS (MDOS), which was written by (or for) the manufacturer of the disk drives. MDOS offers a collection of programs which are useful in the development of assembly language routines. Apart from the usual disk I/O routines, MDOS contains an 8080/8085 assembler, a text editor, and several utilities for copying disk files or entire disks. There are also routines for console and printer character I/O, buffered line I/O, text line parameter parsing, file management and 16 bit arithmetic.

Also supplied is Micropolis Disk Extended BASIC, an interpreter and support software for a particularly powerful dialect of BASIC. MBASIC has a number of unusual features, including selectable multiple precision arithmetic with up to 60 digit variables. The interpreter supports six different data types, including integers, integer arrays, floating point arrays and character strings up to 250 characters long. Integer and floating point arrays may have up to four dimensions, while string arrays may have up to three dimension plus a length parameter.

Naturally, MBASIC has all the usual file I/O commands, and allows files to be opened simultaneously for both sequential and random access in both read and write modes. Up to 10 files can be open at one time, and files can be opened for rewrite instead of append using a clear option. Data is written to and read from files using get and put statements with variable lists that allow a mixture of numeric and string variables.

Files must be closed after use – an END option provides an on-end file-goto capability, which simplifies processing of variable length files.

Standard statements in MBASIC include CHAIN (to allow linking of programs) DATA, DEF, EXEC, INPUT, MEMEND, NOFLOW and FLOW (to enable and disable the program trace feature), OUT, PLOADG, SIZES, STOP and STRING, as well as all the ANSI standard and other accepted BASIC statements. The CHAIN is a true chain that passes variables from the current program segment to the next one loaded from the disk. EXEC is a unique statement that allows a string variable or constant to be executed as if it were a predefined program line.

The FMT (X, Y$) function will return the value of X as a string formatted per the image string Y$. This allows pretty printing for invoices, statements, etc. As well as the standard DEF FN (define function) statement there is a DEF FA statement which allows assembly language routines to be linked into programs.

Word management

This is probably the major application area of microprocessors in offices, and the Vector MZ is ideally suited to the job. Basically, a word processor has to perform several related functions concerned with the creation, editing, filing and printing of documents and other text.

The Vector Graphic Word Management System is designed to be used by people who are not experienced with computers. It therefore makes a lot of use of prompting, often saving the operator from having to type in cumbersome commands. For example, when the directory of documents is displayed on the screen, any document can be retrieved from the disk merely by moving the cursor over its name and then hitting the return key.

In creating a document, text is typed into the computer in free form, that is, without doing carriage returns at the edge of the screen, and the system will automatically insert carriage returns as it shuffles text about on the screen (for example, after inserting or deleting words or phrases).

The system keeps an entire document of up to 24 pages in memory at one time, so that it does not have to access the disk to retrieve or store each page. Thus the whole document can be read through on the screen, for proofreading. The screen can be scrolled line-by-line or page-by-page, under operator control, or alternatively, automatic scrolling can be used, at selectable speeds. (A feature the writer liked so much, he's now incorporated it into his own I/O routines!)

On screen editing is character-oriented, or more correctly, cursor-oriented. To insert characters into text on the screen, the cursor is moved to the desired position, the editor is put into the 'enter' mode, and the insertion is then typed in. As the text is entered, the following words on the line move to the right, and the text wraps around and down the screen. A similar procedure is used to delete characters or words.

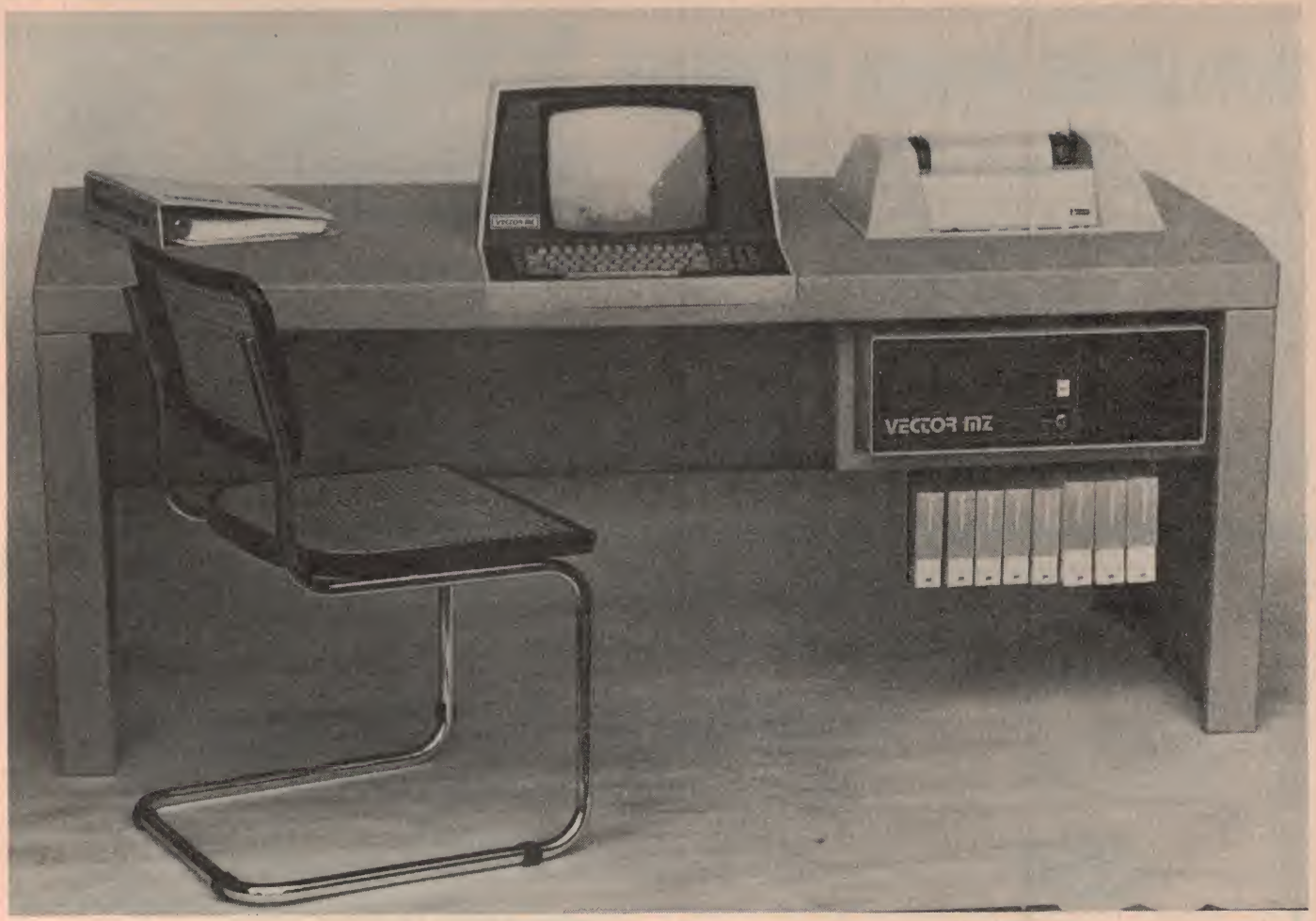
Like other good text editors, the Word Management System features a 'global search and replace' command. This will search right through a document, correcting a particular mis-spelling whenever it occurs. When editing an American technical article for publication in a British-speaking country, for example, an editor might use this command to change the word 'tube' to 'valve' throughout the article.

Moving text within the document is particularly easy - some other text editors seem to make an awful mess of this job. Special delimiting characters are placed at the beginning and end of the text to be moved, and then the move command simply moves all the text between these delimiters to the location indicated by the cursor. This system is well-nigh foolproof.

Pretty printing

But editing is only half the story of a word processor. It also has to be able to print the final documents, preferably with good enough quality to permit reproduction by photocopying or instant printing. The Word Management System is designed to be used with a Diablo or Qume printer, both of which offer good quality printing with a number of special features.

Tabs can be set at any position on the line, and these are indicated on a rule at the top of the screen. One can



The 'Memorite' word processing system has the same basic hardware as the System B but can be used with a Diablo or Qume printer to provide good quality copy suitable for photocopying or instant printing. Software for the system is contained in ROMs and the dual mini-floppies are used for data storage. You can edit text from the screen, which has an 80 column by 24 line format, and you can print at any time – as many times as you wish!

type directly from the keyboard to the printer, just like an ordinary typewriter, if need be.

Printing may be done on any length page, with automatic printing of headings, folio lines and page numbers. For documents that are to be printed on both sides of the paper, the page numbers, headers and footers can even be made to alternate between the right and left sides of the page!

Printing can be done above or below the normal line, allowing the use of subscripts and superscripts, a very useful feature for scientific and technical writing.

Printing can be started and stopped in the middle of a document, allowing printing on separate sheets of paper, rather than continuous stationery. A particularly useful feature is the ability to merge a list of names and addresses into text, allowing the printing of individualised letters ('Dear Mr. Smith, You alone in the whole of Sydney have been selected for this special offer . . .).

In the time that I spent with the machine, I didn't really have a chance to try out any of its more sophisticated features, but I was fairly easily able to pick up the basics of simple text editing. The manual is written in semi-tutorial form for, say, a secretary, rather than someone who already has some knowledge of computerised text editing, and this slowed down my progress somewhat, causing some frustration! However, there is no doubt that the manuals are nearly ideal for their purpose.

The system uses control codes as commands, and these have to be remembered, but this is not difficult to do, particularly if one is using the machine a lot.

Other software

As well as the Micropolis MDOS and MBASIC, the MZ will also run CP/M, the well known disk operating system. To match this is CBASIC, a BASIC pseudocompiler which has a more structured form than standard BASIC and runs considerably faster. For heavily commercial applications, CIS (Compact, Interactive, Standard) COBOL is also available for the MZ, and since this generally follows the ANSI standard, it should be possible to run a lot of commercial software on the MZ.

A variety of applications software for the assembly language programmer is also available, including a disassembler, a universal video driver, and the Vector Graphic ZSM, a Z-80 assembler with conditional assembly and linking loader.

Also in the pipeline for the MZ is a data base management system.

Overall, the Vector MZ is a well-designed and built microcomputer which offers trouble free and reliable operation primarily for the small business user. It can perform most accounting and word processing tasks, and requires no technical knowledge to operate. For those contemplating the purchase of a computer to do some real work (not just play games) it comes highly recommended. ●

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03	6000	.22	76	1200	.40	183	500	2.89	326	500	1.30
05	3000	.22	78	300	.40	190	600	.77	327	500	1.30
08	500	.22	85	2000	.92	191	400	.77	348	600	1.19
09	2000	.22	90	1000	.54	192	700	.80	352	350	1.30
10	1000	.22	92	1500	.54	193	800	.90	353	600	1.30
11	2000	.22	93	1000	.54	194	400	.90	362	300	5.64
12	2000	.22	95	2000	.72	195	300	.80	366	500	.50
13	1000	.40	96	1000	.71	221	2500	1.01	368	500	.50
14	500	.58	107	500	.37	240	500	1.27	379	500	1.30
15	800	.22	109	800	.37	241	3500	1.27	386	700	.37
20	2000	.22	113	300	.37	242	500	1.27	393	600	1.30
21	1600	.22	122	400	.51	244	2500	1.27	396	400	1.81
22	1000	.22	123	3000	.70	247	200	1.27	398	500	2.17
26	600	.22	124	500	.94	248	500	.98	399	300	1.30
27	500	.24	125	2500	.43	249	200	.98	424	200	3.98
28	300	.24	132	200	.72	251	600	.80	447	400	1.30
30	800	.22	136	500	.37	257	1000	.80	490	400	2.24
33	200	.24	138	9000	.67	261	500	1.81	568	350	1.09
37	500	.24	148	300	.87	266	5000	.37	669	50	1.09
38	1500	.28	153	500	.61	273	500	1.27	673	250	9,06
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COMMUNICATIONS

Amateurs aid bushfire fighters

Last December's bushfires around the Sydney region put the NSW Wireless Institute's Civil Emergency Network (WICEN) teams to the 'acid' test — and they showed their mettle in fine style.

The Sydney North WICEN organisation, under regional co-ordinator Barry White VK2AAB, was activated on December 17th 1979, at 1400 hours.

By 1500 hours, they had established 2m VHF (primary) and 10m HF (secondary) bases at the Hornsby Shire fire control centre, which was the operational headquarters for two of the three emergency fire controllers.

For the next 52 hours Sydney North WICEN provided continuous fire-line communications with WICEN mobile units attached to the tankers and crews of bush fire brigades from distant areas who were not fitted with the Bush Fire Council's emergency channel.

Mobile canteens proceeding into the fire areas to feed bush fire crews were accompanied by a WICEN vehicle which ensured that all crews were fed despite limited visibility resulting from the heavy smoke pall and the continuous movement of the brigades.

A WICEN 2m base was established at Warringah fire control centre during the afternoon of the 17th with a direct link to the Hornsby WICEN base. Here there was a pressing need for operators on the Bushfire Council's emergency channel, which could not be met by the staff of the Warringah Bushfire centre due to their complete commitment to their own channel. WICEN took over operating the emergency channel late that afternoon, and manned it continuously for the next 48 hours.

At some distance from the fire control centre, a WICEN roster officer and assistants were on duty to handle the offers of assistance from members, to roster personnel on and off duty and to handle the many other things that need attention during emergency situations. The roster crew had their own 2m calling channel and telephones,

The Colo WICEN base. Les Paul VK2YLP on the RTTY link.

and this location became the rendezvous point for WICEN personnel, leaving the operational channels free of administrative matters.

For the next 24 hours WICEN also supplied a competent operator for the Bushfire Council's emergency channel base station in Sydney.

By 1800 hours on Wednesday 19th December the three major fires were under control, the emergency declarations were revoked and WICEN was stood down to standby alert.

On the following Saturday the Clarence fire to the north-west of Sydney, fanned by strong north-west winds, jumped the control lines. By Sunday the 23rd it was moving south and east on a broad front threatening many small settlements and posing a serious threat to the towns dotting the Blue Mountains area.

Sydney North WICEN was activated on the Sunday afternoon and rapidly established VHF and HF bases at the Baulkham Hills Shire fire control centre with links to two WICEN communications vehicles at the village of Bilpin, some 50 kilometres away on the most easterly edge of the fire. These vehicles became the communications centre for bushfire brigades from the Sydney area which had been despatched to assist the Blue Mountains and Colo Shire bushfire brigades. These assisting brigades could communicate with each other but due to terrain and distance could not maintain reliable communications with their parent base stations. WICEN provide continuous links which enabled relief crews, spare parts etc to arrive at the fire ground and maintain the operational efficiency of the fire fighting force.

At about 2100 hours the Emergency fire controller urgently requested a RTTY link from his headquarters at Katoomba to the Colo Shire Councils fire control centre, about 50 km east. Bearing in mind that it was 9 pm on a Sunday night at the start of the major holiday season, this was not an easy request to meet. It was put to the Sydney RTTY group who, by midnight, had transported two operators and RTTY gear some 50 km and had established RTTY and VHF voice links from the Colo fire control centre to the Katoomba centre.

At the same time, the Blue Mountain regional WICEN co-ordinator, Stuart Brown VK2RY, was activated and had proceeded to Katoomba to estab-

lish a RTTY terminal there. This facility was provided with the minimum delay possible, but the arrival of south easterly winds and cooler conditions during the late afternoon of Christmas Eve stabilised the fire situation and permitted a stand down of WICEN by 1800 hours.

This was not, however, the end of WICEN's activities; during Christmas Eve afternoon an emergency fire controller was appointed to deal with a fire in very rugged terrain some 40 km north-west of Gosford. The Central Coast WICEN group, under regional co-ordinator Ray Wells VK2BVO, was put on an immediate alert. The emergency controller deferred full scale containment action until 0600 hours on 27th December when WICEN went into the field, providing VHF and HF communication links from the brigades to the Gosford fire control centre and liason communications with the Australian Army units engaged on the fire line.

The terrain was such that only four-wheel drive vehicles could safely negotiate the tracks around the fire, and at times it was taking an hour or more to travel 10 km. The Central Coast group was in the field continuously from 0600 hours on the 27th until 2200 hours on the 28th, when the fire was declared safe and WICEN reverted to standby status.

Standby rosters of WICEN personnel were maintained throughout the New Year holiday period until appreciable rains in early January eased the bushfire situation.

From records maintained throughout the period 17th to 28th December, some 86 WICEN personnel were activated (either on duty or on standby) during the Sydney, Clarence and Gosford fires. This does not include the non-amateur personnel who provided assistance in the Transport and catering fields. It is estimated that WICEN personnel spent over 1750 man hours in the field, and the man hours spent on standby by relief crews must have run into several thousand.

Such a wide variety of communications equipment was utilized and on standby throughout the period (VHF and HF bases, mobiles, hand-helds, regulated power supplies, batteries aerials, masts, RTTY terminals, VHF repeaters, test gear etc) that it is virtually impossible to estimate its total value, but $100 000 would be a conservative figure.

WICEN responded to the emergency situations rapidly and efficiently, without materially depleting their reserves of manpower and equipment. The strength of the organisation is such that it could have mounted and maintained at least two additional major operations in the Sydney area without drawing upon the reserves in adjacent country regions, said Howard Freeman VK2NL, NSW State WICEN co-ordinator who provided this report.

1980 ARRL Handbook

This year's Radio Amateur's Handbook, by the ARRL, has just recently become available.

The 1979 issue saw a complete revamp of the content, style and layout, as well as the size — the popular reference work going to a larger page size.

The 1980 Handbook continues the new format with some amendments and improvements — notably, the addition (or is that re-addition) of the Vacuum Tubes and Semiconductors chapter. It seems that vacuum tubes — valves to you — will be with us in communications equipment for some time to come, so the return of the chapter is timely, and will undoubtedly be appreciated.

Most chapters have had changes in their content, clearly to keep up to date. Chapter 14 now covers Specialised Communications Systems, including narrow band voice modulation, satellite communications, SSTV, RTTY and ATV under its umbrella.

It's the 'bible'. Recommended — though I wish they'd list References at the end of each chapter as they do in their smaller, specialised handbooks. Our review copy came from the Technical Book and Magazine Company.

Roger Harrison

Further note on the 70W 6m/10m booster amp

The overlay was perhaps not as clear as it could have been in a few places.

The coax cables, A and B, shown near the changeover relay, seem to have their shields connected to the RF output track beneath them. Actually, the lead going up to the comment 'shields earthed' indicates what to do with them. Strap them to the ground to the left of the relay, adjacent to the shim strap.

Response to the project has been encouraging, we might see a few more big signals appear on the bands over the next few months!

shortwave loggings

Broadcasts from Tibet

In recent months there has been a dramatic upsurge in listening to the many regional broadcasts from China.

For a long time, verifications (QSLs) from Chinese regional stations were virtually impossible to obtain and about the only way was for reports to be sent to Radio Peking itself.

More recently, there has been a significant change in the QSL policies of Chinese broadcasting stations and DXers around the world have reported receiving fully detailed QSLs from may of these stations, often for reports sent to them direct.

An interesting feature of the regional broadcasting pattern is the emergence of programmes featuring "English language lessons" which are often given during the local Chinese evening transmission period. As many of the stations use relatively low frequencies, this makes for good propagation into Australia and provides plenty of scope for the preparation of detailed reception reports.

One such station is the Xizang Peoples' Broadcasting Station (Tibet) with a transmitter complex in the capital of Lhasa. One such station is the Xizang Peoples' Broadcasting Station (Tibet) with a transmitter complex in the capital of Lhasa.

This station operates two shortwave networks, according to this schedule:

Network 1: Chinese service 2230-0645 and 1000-1545 using 7170 kHz, 5935 kHz, and 4750 kHz. English lessons are broadcast in this service at 1400 (Mondays, through Fridays) and at 1500 (Saturdays and Sundays).

Network 2: Tibetan and dialects: 2230-0645 and 1000-1545, on 9680, 9490, 5995, 5240, and 4035.

English Language Lessons are not given in Network Two. This pattern is reflected in the schedules of various other Chinese Regional stations, in which we see the recent orientation of Chinese politics towards the Western World.

The Neimenggu Peoples' Broadcasting Station (Inner Mongolia) also runs two networks: Chinese Network: 2145-0555 and 0900-1520 using 3935, 3970, 4525, 7106 and 7300; Mongolian Network: 2130-0600 and 0900-1525, on 4010, 5982, 6974, and 9522. QSLs have also been received by DXers from this station, which in earlier years were almost impossible to acquire!

Card issued by the Xizang (Tibet) People's Broadcasting Station

Greece.

The Greek Radio and Television shortwave service introduced a new schedule on 2 March, and the programme for Australia are now:

0900-0950 (Greek and English) 17 830 and 21 455; **210-2150** (Greek) 9760, 9530, 9640; **2200-2250** (Greek) 9640.

The first two frequencies at 0900 are now transmitted via the short-path, extending across Asia, due to the long path circuit not offering reliable propagation during our winter months.

Also of note are the transmissions from the lower powered (35 kilowatt) transmitter at Thessaloniki, intended for European audiences, but which provide interesting DX catches here in Australia.

These are now scheduled: 1000-1430 on 11 860, 1830-2030 on 9570.

On Sunday only, there is a third transmission, from 0500-0830, including a direct broadcast of church services in Athens, on 11 860.

During our winter, the broadcasts intended for North America from 2200-2350 will give useful secondary reception in Australia, on 9615 and 7125, with segments in Greek, Portuguese, Spanish, and English.

Sweden

Radio Sweden changes on 6 April affect transmissions for Australasia and the Far East.

Some new outlets are listed, and will make useful targets for DXers wanting to explore band occupancies. English 1100-1130 21 690; French 1130-1200 (formerly 1330-1400) on 21 490; English 1230-1300 and Swedish 1300-1330 15 240; Swedish 1300-1330, Russian 1330-1400, English 1400-1430, Swedish 1430-1500 all on 21 700; English 1700-1730 (was 1600-1630) on 15 240.

Holland

Radio Nederland, Hilversum, is now using the out-of-band outlet of 17 605 for various transmissions.

This frequency was put into effect on 2 March, and is heard with the English segment 0700-0720 (Africa), Dutch 0830-0920 (Middle East), English 0930-1020 (Europe).

Continuing use is noted by Radio Nederland of the 11 metre band; 25 650 is in use from the Madagascar relay base from 0730-0820 for the Dutch programme for South East Asia, and it generally gives good reception here in Australia.

Bangladesh

An interesting area of the world at any time, Bangladesh operates an overseas service which recently changed over to the M-80 schedule.

The complete schedule is: English 0445-0515 15 400, 7245, 21 685; 1230-1300 15 285, 21 670; 1815-1915 11 765, 15 285 (including 15 minutes of dictation news for diplomatic missions abroad); Arabic 0515-0545 15 400, 7245, 21 685; Nepalese 1115-1145 7245, 9720; Urdu 1400-1500 11 875, 15 400; Hindi 9540, 11 765; Bangla 1645-1815 11 765, 15 285.

African and Latin American log

The 1980 African and Latin American Radio Log, published by ARDXC, is now available.

It contains a listing of all tropical band stations in those areas heard in 1979 until the present, and also includes Latin American reception on the international SW bands.

Times of fade-in and fade-out are shown, and a comprehensive QSL summary is also given. Introductory notes about propagation from the African and Latin American regions is also featured.

Copies of the Log are available from the ARDXC, to non-members, for a nominal charge to cover printing and mailing costs, of $2.00. Use the address elsewhere in the page.

PREDICTIONS MAY 1980

Covering 3 to 40 MHz, these predictions show the times radio contact is possible between the areas designated beneath each graph, as well as the possible 'mode' and reliability. Vertical columns indicate time — commencing at 0000 UT on the left, to 2300 UT at right. For reliable predictions follow the times and frequencies indicated by the F character.

Complete information on using these predictions can be obtained by sending a large, stamped, self-addressed envelope to:-

ETI — Predictions
3rd floor 15 Boundary St
RUSHCUTTERS BAY NSW 2011.

These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

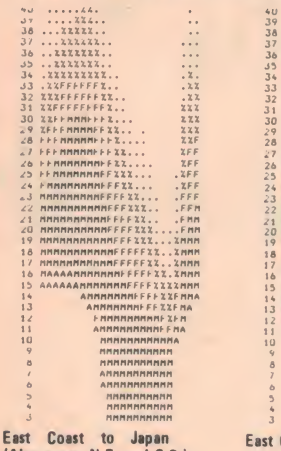
F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

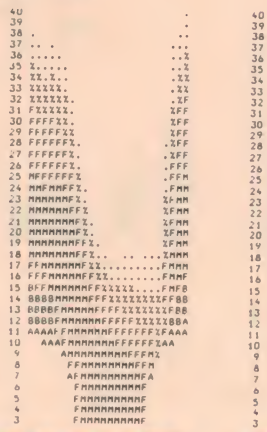
M . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

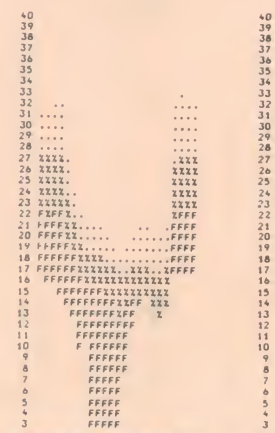
A . . . . . High absorption indicated. Expect weak signals.



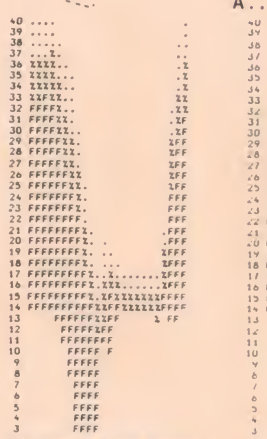
East Coast to Japan
(Also serves N.E. and S.C.)



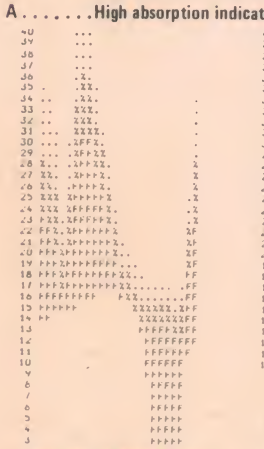
East Coast to South Pacific



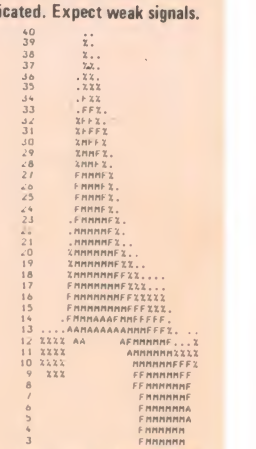
East Coast to North America
(Also serves N.E. and S.C.)



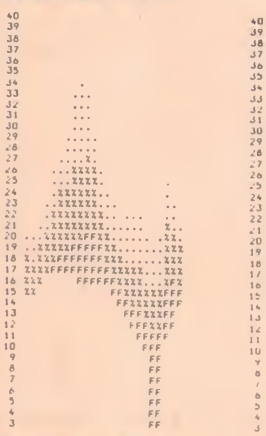
East Coast to South America
(Also serves S.C.)



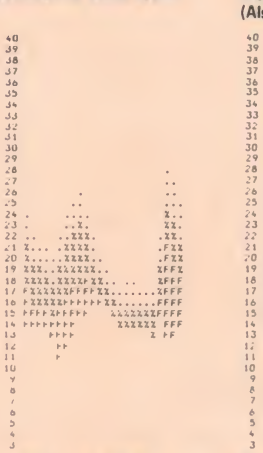
East Coast to North Africa
(Also serves S.C.)



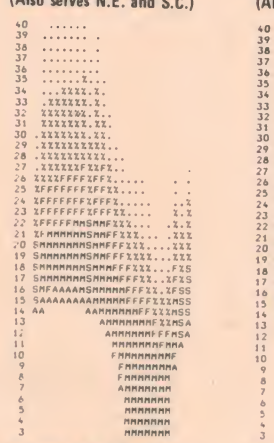
East Coast to South Africa
(Also servas S.C.)



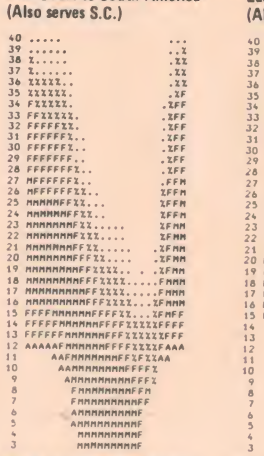
East Coast to Europe
(Short Path)



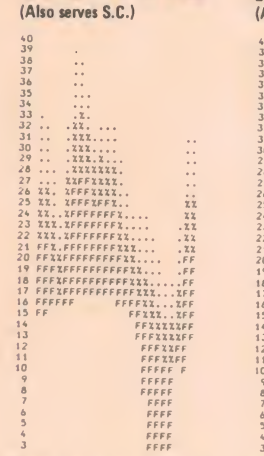
E.C. and S.C. to Europe
(Long Path)



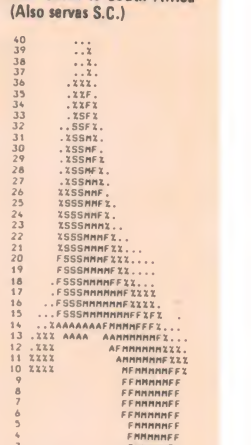
East Coast and S.C. to Persia



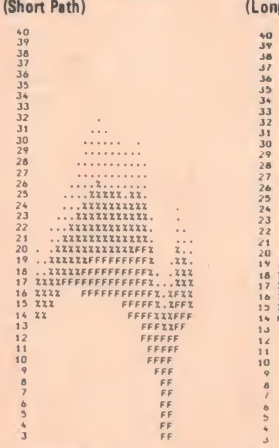
North East to South Pacific
(Also servas S.E.)



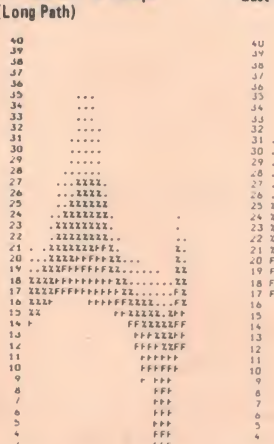
North East to North Africa



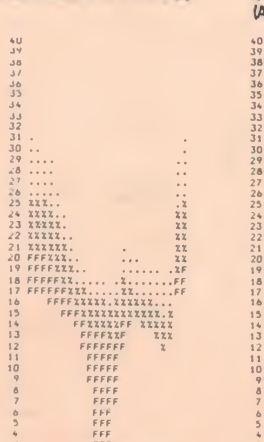
North East to South Africa



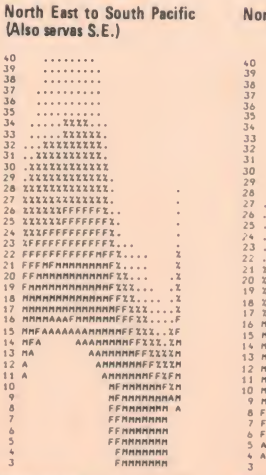
North East to Europe
(Short Path)



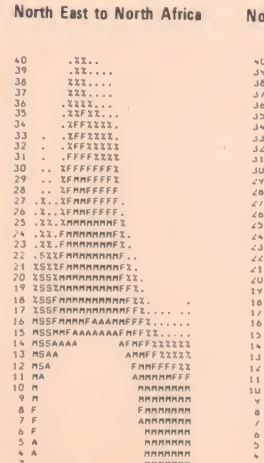
S. Central & W.C. to Europe
(Short Path)



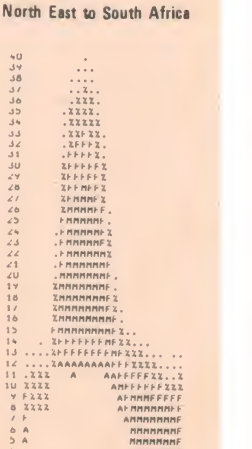
West Coast to North America



West Coast to Japan



West Coast to North Africa



West Coast to South Africa

TASMAN ELECTRONICS

12 Victoria St, Coburg, Vic. 3058. Ph 354-5062.

Minimum postage $1.00.

TRANSISTORS

AC127	.90
AC128	.90
AD149	2.95
AD161	2.20
AD162	2.20
BC107	.35
BC108	.35
BC108C	.39
BC109	.35
BC109C	.40
BC177	.35
BC177B	.65
BC178	.35
BC179	.40
BC318	.22
BC319	.22
BC320	.22
BC182B	.20
BC286	.16
BC287	.16
BC327	.30
BC337	.30
BC338	.30
BC547	.19
BC548	.19
BC549	.19
BC549C	.20
BC557	.20
BC558	.20
BC559	.20
BC639	.40
BC640	.40
BCY71	.69
BD131	.65
BD139	.59
BD140	.59
BD262	1.20
BD263	1.20
BD647	1.90
BD648	1.90
BDV64B	3.19
BDV65B	3.19
BF115	.65
BF338	.90
BFW10	1.40
BFX84	.82
BFY50	.85
BFY51	.85
BFY90	1.50
BU126	3.90
BUX80	9.95
MJ802	4.20
MJ2955	.90
MJ4502	4.20
MJE340	1.30
MJE2955	1.50
MPF102	.60
MPS3565	.18
MPS3538	.18
MPSA05	.30
MPSA06	.30
MPSA12	.50
MPSA14	.45
MPSA55	.30
MPSA92	.40
MPSA93	.55
PN3564	.24
PN3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
PN3569	.18
PN3638	.18
PN3638A	.22
PN3641	.20
PN3642	.20
PN3643	.20
PN3644	.22
PN3645	.22
PN3646	.22
PN3693	.29
PN3694	.29
PN4121	.35
PN4248	.22
PN4250	.29
PN4355	.29
TIP31A	.65
TIP31C	.85
TIP32C	.85
TIP2955	1.60
TIP3055	1.00
TT800	1.20
TT801	1.20
2N697	.60
2N918	.65
2N2102	.82
2N2219	.50
2N2219A	.65
2N2222A	.35
2N2368	.25
2N2484	.55
2N2646	1.00
2N2647	1.20
2N2904	.50
2N2905	.50
2N2905A	.50
2N2906A	.50
2N2907	.50
2N2907A	.50
2N3053	.55
2N3054	.90
2N3055	.75
2N3107	1.20
2N3300	.85
2N3302	.60
2N3638	.55
2N3638A	.59
2N3642	.59
2N3702	.20
2N3703	.30
2N3704	.30
2N3740	1.60
2N3819	.40
2N3904	.25
2N3906	.20
2N4030	1.00
2N4032	.80
2N4033	1.00
2N4036	1.20
2N4037	1.30
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2N4234	2.10
2N4235	1.70
2N4238	1.90
2N4401	.20
2N4403	.20
2N5086	.25
2N5087	.25
2N5088	.30
2N5089	.25
2N5210	.50
2N5458	.50
2N5459	.55
2N5461	.90
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2N5485	.65
2N5871	1.70
2N5872	2.25
2N5873	1.70
2N5874	1.85
2N6027	1.00
2N6124	1.20
2N6126	1.30
2N6129	1.40
2N6130	1.30
2N6132	1.60
2N6134	1.70
3N140	1.70
3N201	1.60
3N210	1.70
40673	1.40

DIODES

AAY30	.40
BA244	.22
BP104	2.80
BYX71	1.20
HP5082	
2800	2.50
OA47	.40
OA90	.20
OA91	.20
OA636	.70
P600G	.90
1N3493	1.70
1N3493R	1.70
1N4001	.08
1N4002	.10
1N4004	.10
1N4007	.20
1N4148	.06
1N5404	.40
1N5408	.80

BRID. RECT.

400V,1A	1.50
400V6A	3.60
200V1½A	.75
100V 2A	.95
100V35A	3.40

VOLT. REG.

309K	1.90
317T	2.90
317K	2.90
323K	8.95
723	.55
7805	1.00
7805K	2.10
7812	1.00
7812K	2.40
7815	1.00
7818	1.00
7824	1.00
78H05	7.50
78H12	7.50
78HG	7.95
78P05	8.00
78L05	.40
78L09	.40
78L12	.40
78L15	.40
78L18	.40
78L24	.40
78CB	2.40
7905	1.85
7905K	2.95
7906	1.85
7908	1.85
7912	1.85
7912K	2.95
7915	1.85
7918	1.85
7924	1.85
79HG	10.80
79L03	.95
79L05	.95
79L12	.95
79L15	.95
79L18	.95
79L24	.95
78MGT2C	1.80
79MGT2C	1.80

LINEAR

301	.40
307	.70
308	1.20
310	2.60
311	.70
318	3.20
324	1.00
339	.90
358	.70
377	2.70
378	4.20
379S	6.90
380-8	1.50
380N14	1.50
381	2.30
381AN	3.96
382	2.00
388	1.38
555	.35
556	1.20
565CH	3.30
566	3.10
567CH	3.00
709	.80
710	.80
711	.80
741	.30
747	1.00
748	.60
771	.50
1458	.60
1558	1.90
2917	3.20
3089	4.20
3914	4.50
7392	3.30
CA3046	1.65
CA3086	.65
CA3130	1.50
CA3140	1.50
CA3302	.70
CA3401	.80
MC1494L	6.65
OM350	7.90
RC4136	1.45

PROMS

93448	10.50
2708	12.00

INTERFACE

1488	1.00
9368	2.30
8T24	2.20

RAMS

2102A-4	1.90
2114-N	6.50
2114-3	8.00
2102	1.60

74LS

74LS00	.30
74LS01	.30
74LS02	.30
74LS03	.30
74LS04	.30
74LS05	.30
74LS08	.30
74LS09	.30
74LS10	.30
74LS11	.35
74LS12	.30
74LS14	.80
74LS15	.75
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74LS27	.30
74LS28	.35
74LS30	.30
74LS32	.30
74LS37	.40
74LS38	.40
74LS40	.30
74LS42	.45
74LS73	.60
74LS74	.40
74LS75	.50
74LS78	.65
74LS85	1.40
74LS86	.60
74LS90	.60
74LS92	1.00
74LS93	.85
74LS95	1.00
74LS107	.65
74LS109	.50
74LS113	.50
74LS114	.55
74LS125	.70
74LS133	.30
74LS138	1.10
74LS151	1.00
74LS157	.75
74LS160	.70
74LS163	.80
74LS164	1.40
74LS165	1.40
74LS169	1.90
74LS174	.65
74LS175	.90
74LS190	1.60
74LS191	1.30
74LS192	1.15
74LS193	1.00
74LS194	1.20
74LS195	1.00
74LS196	1.60
74LS197	1.60
74LS221	1.50
74LS247	1.95
74LS251	.85
74LS253	.85
74LS257	.75
74LS259	2.20
74LS279	.70
74LS290	1.30
74LS365	.80
74LS366	.80
74LS367	.90
74LS368	.65

7400 TTL

7400	.30
7401	.30
7402	.30
7403	.30
7404	.30
7405	.30
7406	.60
7407	.45
7408	.30
7409	.30
7410	.30
7413	.55
7414	.60
7416	.60
7417	.65
7420	.30
7421	.30
7422	.35
7426	.40
7427	.40
7430	.30
7432	.30
7437	.40
7438	.40
7439	.50
7440	.30
7442	.80
7447	1.10
7448	1.10
7450	.30
7451	.30
7453	.30
7454	.30
7460	.30
7470	.50
7472	.55
7473	.55
7474	.35
7475	.45
7476	.40
7480	1.00
7483	1.40
7486	.55
7489	2.90
7490	.40
7491	1.00
7492	.80
7493	.50
7494	1.15
7495	1.00
7496	1.10
74100	2.00
74107	.70
74121	.70
74123	.85
74132	1.30
74145	1.50
74150	1.50
74151	1.40
74153	1.40
74154	1.40
74157	1.40
74160	1.70
74165	1.70
74172	1.40
74173	2.60
74175	1.20
74180	1.50
74188	3.00
74192	1.80
74193	1.80
74367	.90

CMOS

4000	.30
4001	.38
4002	.40
4007	.30
4008	1.20
4011	.38
4012	.30
4013	.65
4014	1.40
4015	1.20
4016	.60
4017	1.30
4018	1.30
4020	1.40
4021	1.30
4022	1.30
4023	.30
4024	1.00
4025	.30
4027	.70
4028	1.00
4029	1.60
4035	1.20
4040	1.40
4042	1.20
4043	1.00
4044	1.00
4046	2.20
4049	.70
4050	.75
4051	1.20
4052	1.20
4053	1.20
4060	1.50
4066	.90
4068	.45
4069	.30
4070	.30
4071	.30
4072	.30
4076	1.75
4077	.30
4078	.60
4081	.30
4082	.30
4093	.70
4441	.95
4502	1.40
4506	.70
4510	1.50
4511	1.30
4518	1.80
4520	1.40
4528	1.40
4553	6.90
4555	1.00
4581	3.50
4582	1.40
4584	1.00
40014	.90
40097	1.00
40098	1.20
74C02	.35
74C04	.35
74C08	.35
74C10	.35
74C20	.35
74C48	2.50
74C73	1.10
74C76	.95
74C90	1.40
74C93	1.40
74C175	1.70
74C192	1.90
74C193	2.70

DISPLAYS

FND357	1.40
FND500	1.40
DL747	3.50

OPTO COUPLER

MCT2	.75

SCR's

C103YY	.80
C106Y	.65
C106D	.90
C106E	.70
C122D	1.30
S4015L	1.90
S2025H	3.75

TRIACS

SC141D	1.30
Q4015L5	2.80
BT139	2.80

TRIGGER DIODES

ST2	.55
ST4	.80

LED's

RED	.18
GREEN	.30
YELLOW	.30
CLEAR	.25
TIL209	.18
FRD(fl)	2.30
SEL102S	.30
SEL103S	.30
SEL302E	.40
SEL303E	.40
SKNR	1.20
SKNG	1.70
SKNY	1.80
SEL351	1.10
LD271A	.80

ZENERS

½ WATT	.19
1 WATT	.30
2½ WATT	.65
5 WATT	1.20

MICROS

6800P	11.50
6821	6.50
6850	6.50
TMS1000	7.95

TANTALUM

35v

u1-u68	.25
1u-10u	.30
15uF	.55
22uF	.74
10uF/25V	.25

16V

4u7	.20
22uF	.30
47uF	1.30

6.3V

47uF	.40
100uF	1.10

CERAMICS

1P-u01	.06
.0056uF	.10
.0068uF	.12
.0082uF	.20
.047uF	.08
.1uF	.12
.22uF	.22
.47uF	.25

GREENCAPS

100V

.001uF to .027uF	.10
.033uF to .056uF	.12
.068uF to .1uF	.16
.12uF to .22uF	.30

250V

.27uF	.30
.33uF	.34
.39uF	.48
.47uF	.50
.56uF to .82uF	.60
1uF to 1.5uF	1.00
1.8uF	1.20
2.2uF	1.40
3.3uF	2.10
4.7uF	3.50

630V

.001uF to .0082uF	.20
.01uF to .015uF	.25
.022uF to .033uF	.30
.047uF to .1uF	.40
.22uF	.60
.33uF	.80
.47uF	.85

TRIM CAP

—5.5pf	.30
—22pf	.40
—40pf	.40
—65pf	.30

ELECTRO. RT.

16V

33uf	.15
330uf	.40

25V

100uf	.25
330uf	.45
2500uf	1.00

50V

2500uf	2.15

63V

10uf	.16
47uf	.30
100uf	.40
220uf	.65
470uf	.75
1000uf	1.65

RB. (PCB)

6.3V

470uf	.20
1000uf	.30

10V

4.7uf	.10
100uf	.10

16V

10uf	.08
22uf	.10
33/47uf	.10
100uf	.15
220uf	.20
330uf	.20
470uf	.25
640uf	.45
1000uf	.40
2500uf	.65

25V

2u2/3u3	.10
4u7/10u	.10
25u/33u	.12
47uf	.13
100uf	.15
220uf	.20
330uf	.25
470uf	.35
1000uf	.50
2200uf	.90

35V

2u2/3u3	.10
10uf	.15
100uf	.20
220uf	.30
1000uf	.70
2000uf	.90
2200uf	1.10

50V

0.47uf	.08
1u/2u2	.08
3.3uf	.15
4.7uf	.15
10uf	.15
22u/33u	.20
47u/100u	.20
220uf	.50
470uf	.60

63V

0.47uf	.10
1u/2u2	.10
3u3/4u7	.10
10u/25u	.15
47uf	.20
100uf	.25
220uf	.40
330uf	.45
470uf	.80

160V

2.2uf	.20
10uf	.30
22uf	.50

250V

2.2uf	.25

350V

1uf	.20

CAN TYPE

35V

2500uf	1.60
2500uf	1.95

40V

5600uf	2.40

50V

6800uf	5.20

63V

2500uf	3.25

75V

3300uf	5.90

BIPOLAR 50V

1u/2u2	.25
3u3/4u7	.30
6.8uf	.30
10/22uf	.40
33uf	.50
47uf	.69
100uf	.80

POLYSTYRENE

125V

10pf to 680pf	.45
1000pf to 10,000p	.55

RESISTORS

.33W	.03
1 W	.07
5 W W/W	.30
.4W 2p.c.	.10

MINIATURE TRIMPOTS

100 to 1M OHM	.20

MINIATURE MULTITURN

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+ switch	1.80
SLIDER	1.10

CERMET TRIMPOT

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PCB CLIPS	.06

2AG

506	.75

FUSES

3AG

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1-5A	.15

2AG

.25-.5A	.30
.63-4A	.20

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38,39	3.60
40	3.60
22	3.80
26	3.90
20,24	4.50
28	4.90
18,30	6.50
31,32	6.60
33,34	6.60

IC SOCKETS

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14 pin	.25
16 pin	.28
18 pin	.65
24 pin	.80
8 W/W	.33
16 W/W	.90

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HY50	42.00
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7203	2.30
7301R	2.45
8531	1.06
SB4011	1.52
L40 paddle	.12

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PRODUCT TESTS

PROJECTS

Index 1979

Notes & Errata

Simple Interpreter, January 1979
The source listing in the centre of the article did not reproduce very well and can be difficult to follow. The major problem is that the 3E byte at 01BD has printed as 3F which causes the 'yes/no' jump logic always to act as 'no' jump logic.

On page 61, column one, line 13, should read as '... j, k, q, x, and z occur rarely'.

142: High current power supply, February
The wrong gauge wire was shown for coil L2. The correct gauge is 1.6 mm.

557: Reaction timer, February
The circuit diagram shows the Q and $\overline{Q}$ outputs of IC6 crossed over.

Pin 12 is the $\overline{Q}$ output while pin 13 is the Q output. Also, the parts list shows IC4 as a 4513 when it should be a 4018.

642: 16K RAM card, February
The inputs to IC38c on the circuit diagram should come from the BLOCK 1 to 4 lines rather than the CS 0 to 3 lines as shown. Two IC43s were accidentally shown. The lower of the two is the real IC43. The IC above and to the left of this is IC44, a 74LS154. In the list of ICs at the top of the diagram, IC45 should be shown as 74LS175.

491: Simple graphic equaliser, March
A very important resistor was left off the circuit and overlay in this project — A 15.7 k resistor, made from an 18k and 120k in parallel, connects between the output of the gain pot and the input (pin 2) of IC6. The circuit will not work without it.

249: Combination lock, April
First of all, scrap Table 1 and the associated copy above it. Secondly, have faith in the 'How it Works', for it is correct.

The connections to SW1 and SW2 on the circuit are incorrect. Pin 8 of SW1 goes to C(R8). Pin 1 of SW2 goes to D(D2). Pin 4 of SW2 goes to E (C8, R9 and gate of SCR3). Pin 11 of SW2 goes to F (C6, R6 and gate of SCR2). Note that H on the overlay is point K on the circuit.

Overall, dialling the sequential code on SW1 and SW2 should connect, in sequence, B - D, then A - F, then C - E. Work out your code appropriately.

470: 60W low TID module, May
The earth rail onto the amplifier must be returned to the 0 volt connection on the power supply. Although it is obvious to most people it was not indicated on the circuit for the 470 module, but was shown on the wiring diagram for the Series 4000 amplifier system in the June issue.

471: Series 4000 preamp, June
The loudness control produces 8 dB boost at 150 Hz and 10 kHz, rather than at 15 kHz and 10 kHz as the article stated (gremlins again ...). Also, in the circuit diagram the function LEDs are shown the wrong way round with respect to the switch, as in the LED power supply with respect to the overlay. The overlay is correct and should be followed, but either connection will work. In the parts list the resistors R118 and R119 have been omitted. They are both 15k, 1/2 W, 5%.

148: Versatile logic probe, July
Some readers have reported trouble with this project, apparently caused by the large spread in parameters of some 4049 ICs. Try chips of a different manufacture, is the advice we have received. Also, buffered 4049s or even 4009s may be used, but to get correct operation over the range of supply voltage from 5V to 15V, resistors R2 and R3 should be changed to a value of 1M each.

814: Dinky Die, August
Capacitor C2 is shown with the wrong polarity on both the circuit and the overlay. Also, C1 and C2 are incorrectly listed in the parts list. C1 is a 10uF tantalum, C2 is a 33uF tantalum.

731: RTTY modulator, September
If the tone oscillator doesn't oscillate, try placing a 22n capacitor from the emitter of Q4 to common. Note that stability of the oscillator is greatly improved if you use silver mica or styroseal capacitors or C5, C6 and C7

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101	50v 1A x 2, 6·3v 2A	$5·00
105	0-15v 1A x 2	$6·00
110	110v ·3A, 26v 1A	$5·00
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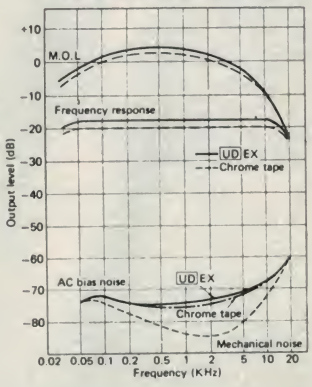
UD-EX MOL/Frequency Response/Noise Spectrum



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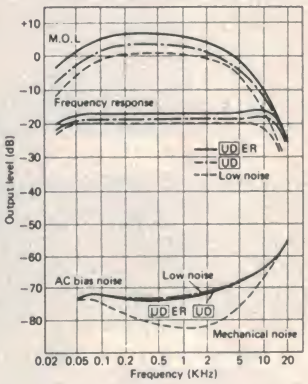
It also improves sensitivity by 2.5 dB over the entire frequency range when compared to conventional low noise tapes.

UD-ER MOL/Frequency Response/Noise Spectrum



The maximum output level is improved by 5.5 dB.

Both cassette tapes feature super precision shells to ensure outstanding head azimuth, accurate tracking position and the smoothest possible tape travel without jamming.

Our UD-EX and UD-ER tapes are a real breakthrough in cassette recording. And like everything we make at Hitachi they are manufactured with uncompromising quality. Try our tapes now. Your sound equipment will reach a new high too.

HITACHI

With Hitachi tape there's no room for compromise.

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COMPTON 4679

sound news

Compact turntable features radical design

Technics' recently released SL-10 turntable represents a radical departure in 'total turntable design', featuring microcomputer control, linear tracking tone arm, direct-drive platter and built-in MC preamp — all in a package the size of an LP record jacket!

This remarkable new turntable occupies the same area as an LP dust jacket, is very slim, yet packs some quite sophisticated mechanics and electronics inside.

The diecast aluminium cabinet opens into upper and lower halves. The upper half contains the tone arm, its drive and the microcomputer electronics. The lower half contains Technics' integral-rotor platter direct-drive motor and its quartz-locked drive electronics. A 'disc stabiliser' built into the upper half holds the record to the platter when the unit is closed during operation.

An optical sensor located near the stylus tip provides positional feedback for the arm servo control. The arm employs a special slide bearing having a low friction coefficient, avoiding undesirable vibrations and allowing smooth, silent operation.

The tone arm construction and disc securing mechanics allows the turntable to be operated on surfaces which are not level, or even standing upright!

Technics developed a new moving-coil cartridge for this system, based on the 305MC. Designated 310MC, the new cartridge features a coreless twin-ring coil structure and a boron pipe cantilever. Technics claim the boron cantiliver contributes to the cartridge's extremely linear, flat frequency response and superb tracing ability.

Built in to the SL-10 is a high S/N head amp to allow the turntable to be used with any preamp. This can be bypassed if you wish to use another MC preamp or a step-up transformer.

Operation is simple with pushbutton controls located on the front panel. The SL-10 features auto lead-in and auto disc size selection, as well as auto repeat and 'repeat from the beginning during play' operations. It also has auto stop and auto return. On top of all that, it will judge for itself what speed to play the disc you insert — LPs will be played at 33 1/3 RPM while EPs will be played at 45 RPM. A manual speed selector is also provided.

The SL-10 can be operated from 240 Vac mains or 12 Vdc supply. More information can be obtained from National Panasonic, Technics Advisory Service, P.O. Box 319, North Ryde NSW 2113.

Ralmar tape/record care accessories

We recently received a small booklet from Ralmar Agencies listing all their tape and record care accessories.

Listed in the eight-page publication are such things as spray cans of record cleaner and tapehead cleaner; deluxe record care kits containing preener, disc holder, stylus brush etc, as well as antistatic fluid, stylus pressure gauges and microscopes etc.

For the cassette enthusiast, they have cassette holders, a combination test and clean cassette, eraser machines, head demagnetizer cassettes as well as standard demagnetising tools. Some 35 products, are listed. See your local Ralmar distributor.

Exhibition develops into Super show

The 5th Australian Consumer Electronics Show, incorporating Interlect '80, is developing into the best industry-represented gathering of electronic manufacturers, importers and wholesalers ever seen in Australia.

The Show will occupy over 13 000 sq metres in four major pavilions at the Sydney Showground from Monday, July 14 to Sunday, July 20, 1980.

Following the first ballot for members of the sponsoring body, the High Fidelity Association of Australia, approximately 50% of total available floor space has been reserved.

Association members who have taken space at the Show include AIWA, Akai, AR Speakers, Convoy International, Hagemeyer, JVC, Hitachi, Philips, Pioneer, Rank Industries, Rose, Sanyo, Sharp, Superscope, TDK and VanFi.

Non-Association members already committed to exhibit include Access Communications, Audio Engineers, Communications Power, Computerland, Concept Audio, Eurovox, Hanimex, Intercept Communications, Kreisler, Sunbeam, Texas Instruments, Trio Kenwood, and Video Programmes.

The early trend amongst non-Association members is to communications and small computer equipment, though Show Manager, Mr Peter Lucas, expects to be able to release information on larger names like Westinghouse, Malleys, Whirlpool, Simpson, Breville, Hoover and others, in the near future.

This year's Show will be supported by a sizeable $80 000 advertising budget, a massive direct mail campaign aimed at a wide cross-section of electrical industry buyers, and a publicity/promotion programme highlighting the strong consumer appeal embodies in all exhibits.

Trade and public attendance hours will be separated to ensure clarity of communication between spectator and exhibitor.

The 5th Australian Consumer Electronics Show, incorporating Interelect '80, is organised by Ridell Exhibition Promotions Pty Ltd.

For further information regarding all aspects of the Show, please contact Mr Peter Lucas, Riddell Exhibition Promotions Pty Ltd, 166 Albert Road, South Melbourne Vic 3205.

FREE HI-FI ADVICE

Before you buy any Hi-Fi, know the answers to these questions.

Is the system really good value for money, and will it sound as good in my home?

Will I have to lug it home and put it together, or will a factory trained technician come and set it up to perfection?

If something goes wrong... will I have the back-up of a three year warranty... and can I be sure I'll have it serviced within 48 hours?

Will my system be set up by factory specialists to get the very best from my room, using equalizers, Real time analyzers, and pink noise generators?

Will my system let me shape the music, to hear it exactly the way I want to hear it... to emphasize the instruments I enjoy?

When you buy Audio Reflex equipment, those kind of questions don't bother you. If you're buying another pretty face from a discount king, well, try and enjoy it, anyway.

For free Hi-Fi advice anytime... drop in on your Audio Reflex Dealer

INSTALLATION & EQUALIZATION SERVICE IN CAPITAL CITIES ONLY

AUDIO REFLEX

Arm and cartridge specialists join forces

Ortofon and SME, renowned cartridge and tone arm manufacturing specialists, respectively, have joined forces to produce an integrated low mass arm/pickup exploiting the technology specialisations of each company.

A short while ago Ortofon introduced its low mass VMS cartridge, the basic version of which weighs only 1.5 grams. They thought it only natural to marry this high compliance cartridge with a low mass tone arm and chose the SME Series III.

Cooperation between SME and Ortofon has resulted in a special version of the detachable arm tube from the SME Series III, which is produced and fitted with an Ortofon low mass, high compliance cartridge.

The total effective mass of this system is only 4.5 grams — less than the mass of most pick-up cartridges alone! This results in a system resonance of 13 Hz, according to Ortofon.

The design philosophy of the SME Series III precision arm anticipated the use of low mass, high compliance cartridges. The Ortofon model SME 30H is thus offered as an integral part of a tone arm interchangeable with those of the standard Series III SME models.

The high compliance cartridge ensures good low frequency tracking ability, even at low tracking forces and the demand for superior tracking ability at the top end of the frequency range has been fulfilled by a reduction in the effective stylus tip mass of 30%, according to Ortofon.

Ortofon are represented here by Harmon Australia P/L, 271 Harboard Rd, Brookvale NSW 2100.

Cassette deck features computer-coded search system

Philips' N2554 programmable front-loading cassette deck features a unique selection search system to find items using inaudible pulses written on the tape.

Selection systems incorporated in many top-line cassette decks search for the pauses between items. The pulse-code system on the N2554 deck allows up to 50 code number to be written on the tape — which Philips say is more than ample, no matter how short the items may be.

This ensures that every recording is positively identified. A special 51st code number orders the tape run right on to the end so that the flip side will always start at the beginning.

The computer-coded search system allows you to find any item on the tape, play it, repeat or just select the first five items, or maybe the last ten — whatever you wish. You can select items at random, string them together in any chosen sequence and even repeat the sequence or individual items indefinitely.

The control system on the N2554 employs 'micro touch' buttons for featherlight control. The complete motor control system is managed by a microprocessor. The programming allows direct switching between functions without using the stop button, simplifying the operating procedure and facilitating tape editing and assembly. An 'invalid selection' produces no result!

The capstan is driven by a tachometer-controlled dc motor. A separate dc motor for tape feed cuts out capstan/feed interaction, driving both reels of the cassette through noiseless precision gears and proportional-torque clutches.

The N2554 accepts all tape formulations, including metal tape, and Philips claim a flat response to 20 kHz on both record and replay with metal tape.

The separate bias and equalisation switches allow the user to set up completely optimise record and replay conditions for chrome and ferro tapes too.

The deck has a 'post-fading' feature which allows you to knock the rough edges and unwanted passages from a recording. Fade-out and fade-in can be smoothly accomplished automatically and the correct erasure intensity is set via the recording bias switch.

This recorder has both Dolby and Philips' Dynamic Noise Limiting (DNL). You can use Dolby nr on both record and replay, but the DNL is only available in replay mode.

Full provision for line and microphone mixing is available and there are separate recording level and balance controls to set up the inputs, plus a master control. Fast rise, slow decay peak reading meters and overmod LEDs (at 4 dB and 7 dB) are provided. For interference-free recording, from both FM and AM MPX and RIF filters are provided.

Wow and flutter (weighted) is quoted at less than 0.1% while S/N ratio is given as 57 dB (DIN) for metal tape and 56 dB (DIN) for chrome.

More information, brochures etc, available from your Philips dealer.

New FM station for Melbourne

Station 3PBS-FM has now been officially opened in Melbourne.

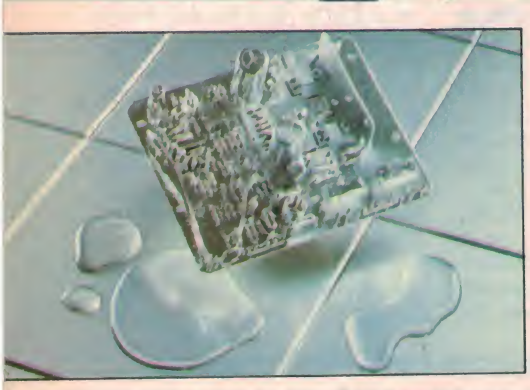
Transmitting from their studios from the Prince of Wales hotel in St Kilda, on 107.7 MHz, they will be presenting everything from mediaeval music through Beethoven, country and rock 'n roll.

The transmitter is at the moment located at the Royal Womens Hospital but will soon be moved to Mt Dandenong.

Sansui

Only hi-fi, everything hi-fi.

Saturation impossible.



Sansui's AU-X1 is the DC amplifier in which current saturation is impossible. So TIM and envelope distortion are virtually nil. And accurate reproduction of musical signals reaches new levels.

THD and TIM

You're probably aware that THD specs only indicate an amplifier's response to simple steady state signals. But dynamic musical signals may generate music-smearing TIM.

TIM, transient intermodulation distortion, can be caused by pulsive musical signals which make ordinary amplifiers cry out in distress. And that means distressful music.

Sansui's powerful solution: the DD/DC circuit

The beauty of Sansui's exclusive DD/DC (Diamond Differential DC) circuit is it allows sufficient NFB for an ultra-low THD and — at the same time — stamps out TIM. The secret of DD/DC (PAT. PEND.)is driving power so powerful that current saturation is impossible. Slew rate: ±260V/μSec: Rise/fall time: 0.5μSec. THD: under 0.007% at full rated 160 RMS watts × 2 output. You hear unprecedented clarity and precision of detail.

Now look closely at the photo. What you thought were bass and treble controls, aren't. They are simply level controls. We admit the AU-X1 integrated amplifier is relatively austere. Because purity in reproducing the most demanding musical signals requires discipline.

SANSUI

AU-X1

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VANFI (AUST.) PTY. LTD.
162, Albert Road, South Melbourne, Victoria 3205, Austraria Tel: 699-5473
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293

In the market for an MC cartridge?

Dynavector's Series 20 high output moving-coil catrridges have won acclaim throughout the world, not just for their ingenious construction but for top sound quality too, according to Concept Audio.

The 20A and 20B Type 2 models feature reduced cartridge mass, improved compliance and increased output, compared to their predecessors.

Cartridge mass has been reduced from 9.5 grams to 5.3 grams, compliance improved from eight to 24 by 10 cm/dyn and output increased from 2 mV to 3.6 mV.

The DV/20A and DV/20B Type 2 models are the successors to the famous Dynavector/Ultimo 20A and 20B cartridges which have enjoyed an excellent reputation. The first is available from Concept Audio dealers for a recommended retail price of $175, while the 20B is priced at $275.

'Professional' versions of the Type 2 20A and 20B are designated DV30/A and DV30/B and these retail for $205 and $265 respectively. They are designed to mate with the SME type tone arms.

Top of the line is the DV30/C featuring the famous 'Paroc' diamond stylus developed by Dr Weinz of West Germany, renowned for its contact shape and precision polishing. The cantilever itself is a boron pipe especially designed to provide a very fast response.

Also new to the Dynavector range of MC cartridges are the models 100R and 100D. the first is a low output device featuring a synthetic ruby cantilever, while the 100D sports a pure diamond cantilever.

The model 100R is available at a recommended retail of $198, and is suitable for teaming with the DV.6X step-up transformer ($175 rrp).

Further details from your nearest Concept dealer or from Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale, NSW 2100. (02) 938-3700.

Etone expands range

Etone Pty Ltd have expanded their range of sound reinforcement products.

The range now includes the Emilar high frequency compression drivers and horns. Etone is also the NSW distributor for Zephyr products of Melbourne, including the RCF professional HF drivers and horns and NZ-made Perraux MOSFET power amps.

Complete information on their products is available from Etone Pty Ltd, 53 Stanley Street, Peakhurst NSW 2210. (02) 435-3569.

Three-way from Audio Reflex

Joining in the boom demand for speakers, Audio Reflex have released a flurry of designs in recent months, the SB485 model being the latest.

The SB485 is a three-way system incorporating a 375 mm long-throw bass driver, a 125 mm mid-range and 50 mm wide-dispersion cone tweeter. The enclosure is a high efficiency vented design of front-to-back bracing construction. It stands 700 mm high and measures 450 mm wide by 375 mm deep. It is finished in walnut grain and features a tapered cloth grille. Each unit weighs 24 kg.

The crossover network has a claimed 12 dB/octave roll-off and the speaker's handling capacity is rated at 100 watts RMS. Audio Reflex quote a frequency response of 30 Hz to 22 kHz.

Interested?, contact Audio Reflex (Australia) Pty Ltd, 7 Orchard Rd, Brookvale 2100 NSW, (02) 938-4188.

New releases from Audio 2000

Audio 2000 recently released two new products from British manufacturers Michaelson & Austin, famous for their valve gear, and the Focus One turntable from Mitchell, a newly-acquired agency.

M&A's new valve amp is the TVA-10, a 50/50 watt stereo amp which is a lower power version of the well-known TVA-1. Together with this amp, M&A have released a 'no frills' valve preamp — the TVP-1, designed to complement the TVA-1 and the TVA-10. The TVP-1 features tape monitoring and sub-sonic filter controls, is finished in black and comes with rack mounting capability.

The Mitchell Focus One is a two-speed, 300 mm platter turntable having fully-sprung legs and comes with a suede mat. A record clamp is also available to assure good coupling between the record and the platter.

For more information, contact Audio 2000, P.O. Box 107, Brookvale, NSW 2100, (02) 939-2159.

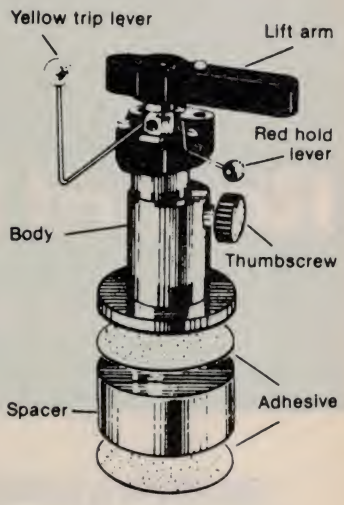
Safety raiser

This sharp little accessory saves damage to your cartridge/needle or records.

The Audio-Technica Safety Raiser model AT6006 is an add-on tone arm lift mechanism that can be used to raise and lower your tone arm onto the record and provide automatic tone arm lift at the end of the disc.

The device can be readily attached to almost any turntable system not having a tone arm lift mechanism.

For more information, contact the Maurice Chapman Group: Sydney 438-3111, Melbourne 818-1730, Brisbane 44-7566 and Perth 446-5679.



Speakers from Jackson

A new range of "Jackson" brand-name hi-fi speaker drive units were released in Australia in November.

The range includes three square-frame woofers (200 mm, 250 mm and 300 mm respectively), two mid-range drivers (a 100 mm cone type and a 125 mm dome type) and a 65 mm square-frame cone tweeter.

Model numbers and quoted specs are as follows:

8-310: 65 mm tweeter (2 — 18 kHz, 92 dB/W sens).

8-403: 125 mm dome mid-range (up to 8 kHz, 560 Hz x-over, 94 dB/W sens.)

8-405: 100 mm cone mid-range (up to 4.5 kHz, 500 Hz x-over, 93 dB/W sens.)

8-540: 200 mm woofer (up to 8 kHz, 50 Hz x-over, 89 dB/W sens.)

8-560: 250 mm woofer (up to 5.8 kHz, 25 Hz x-over, 90 dB/W sens.)

8-580: 300 mm woofer (up to 5 kHz, 30 Hz x-over, 89 dB/W sens.)

For more information, full specifications and pricing, contact I.F.T.A. Australasia Pty Ltd, 1 Greville St, Randwick NSW 2031, (02) 665-8211.

Record Ecology in DiscKit form

— you'll Save more than money

DiscKit is a crafted walnut tray and dustcover that saves you 20% with the Discwasher products in the kit. ($55 versus $69 separately) DiscKit includes: 1) The Discwasher System Record Cleaner with D3 Fluid, 2) the Zerostat anti-static pistol and test light, and 3) the SC-1 Stylus Cleaner.

But you'll save more than money. You'll save your records from imbedded micro-dust, your cartridge stylus from abrasion and your ears from a lot of static.
It's your choice, disposable records or Discwasher. (Walnut tray and dust cover are available separately as the Discorganizer, $15)

Cartridge and Disc Traker (pictured) not included in Kit, ask your nearest dealer for details.

Now includes free, DC1 pad maintenance brush.

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ST-500 AM/FM STEREO COMPUTUNER
features state-of-the-art electronic quartz-locked synthesized tuning with 14 station (7 AM, 7 FM) memory presets. AM tuning is particularly sensitive and, with more FM stations due in 1980, the ST-500 tuner is a sound investment for the future.

PM 700 INTEGRATED AMPLIFIER
features Dual 5-band Graphic Equalizers and delivers 70 watts True Power per channel into 8 ohms.

The current interest in high-definition moving coil cartridges makes the built-in moving coil head-amp on the PM 700 a particular plus. This model offers the most demanding audiophile a new concept in power, price and performance.

SD 8000 2-SPEED CASSETTE DECK
takes your system beyond the traditional limits of cassette deck technology. The Compudeck Feather-Touch control centre (inset left) offers superior programming capability, e.g. up to 19 selections in whatever order you wish. Two speeds give you the flexibility of true high-fidelity recording at 3-3/4 i.p.s. plus the economy of 1-7/8 i.p.s. when recording time is a factor. Also: Dolby Noise Reduction; digital display including clock and LED meters.

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WOW and FLUTTER

how low should you go?

COMPLEX CALCULATIONS accompanied a letter which we received from a reader of our, now ceased, associate 'Hi-Fi and Music' — Mr Robert Clark — who was concerned about problems of wow and flutter in turntables. The points raised in the letter are extremely interesting and give emphasis to some problems we have found when testing turntables.

Modern turntables are claiming better and better figures for wow and flutter — claims which are backed up by test results — but, as Mr Clark points out, the lowest meaningful limit may have been reached already.

Wow and flutter

These terms refer to the wavering of pitch of reproduced sounds due to undesirable speed fluctuations in the recording medium. Wow is a regular slow speed variation, while flutter occurs at a higher frequency than wow and is heard as a bubbly sounding distortion.

Both types of speed variation are audible when present in quite small amounts — even when considerably less than one per cent. This may surprise some readers, for it is known that if the overall speed of a turntable is fast or slow by as much as three per cent or more, it will pass unnoticed, except by those few listeners who possess perfect pitch.

However, sensitivity to a change *as it occurs* is much higher than the recognition of a fixed error, and it is for this reason that relatively small amounts of wow and flutter are audible. To further complicate the issue, some types of music are affected by wow and flutter more severely than others.

Causes

There are a number of causes of wow and flutter in replay components. Wear of mechanisms in the drive system — drive wheels, belts and so on — is an obvious factor, as is poor, or incorrect lubrication.

Tape recorders too are prone to speed variations, for much the same reasons as turntables, but may also have problems with poorly adjusted pressure pads or brakes, dirty tape guides and capstans, and bad design causing excessive drag within the drive system.

Manufacturers are aware of the problem, the various causes and, in the chase for better and better specifications, they are overcoming many of these troubles.

With turntables, the use of heavy platters combined with high torque motors is quite a common method of ironing out short term speed variations by sheer inertia. The principle is simply that of the flywheel, and the momentum of the spinning platter is intended to override any short term influences.

Other methods are also used and, to judge by the specifications accompanying most modern turntables, they are proving successful.

Unfortunately however, there are some problems in the recording medium — quite outside the scope of the manufacturers. In tape recorders there may be unnecessary drag within the tape reels or hubs, or the tape thickness may vary sufficiently to induce similar problems.

Swingers

Quite outside the control of the turntable manufacturer, records themselves may be responsible for the problem. Eccentric records (swingers) are the most obvious cause and are difficult to handle.

Unless a record is exactly centred on the platter there is always some resultant lateral movement which is frequently observed in the motion of the pickup arm. This motion will certainly produce some degree of wow and flutter and will be painfully obvious on some types of music.

Another problem may be caused by warped records — especially if a 'Dust Bug'-type record cleaning device is applied to the record as it plays. We have found in the past that some low torque turntable motors with light platters demonstrate considerable audible speed variations due to the drag as the cleaner is pulled up the ridge of a prominent warp, and then coasts down on the other side.

Records with over-sized centre holes behave in the same way as eccentric records. The swinger is a more obvious problem, but incorrect (off centre) positioning of the disc with the over-large hole, effectively turns it into a swinger too.

This problem has caused us some concern in the past, for when conducting laboratory tests on turntables, our consultants have found test records suffering from this complaint.

A closer examination of these discs in the lab revealed that in some positions on the platter, the 'virtual wow and flutter' (to coin Mr Clark's phrase) almost exactly cancels out the speed variations inherent in the turntable's performance. Yet in other positions, the two variables combine to give quite severe readings, even though the performance of the turntable is well within its specified value.

It is rather difficult to draw any satisfactory conclusions from these arguments. Certainly, if you buy a record which turns out to be a swinger, you should try to obtain a replacement from your record dealer, as you will almost inevitably suffer wow and flutter.

If, however, you have a record with an over-sized centre hole you have a problem indeed. In some positions on the spindle the wow and flutter of record and turntable can combine to give audible problems, while on another playing, the position may be such that the two cancel out to give lower speed variations than the turntable alone is capable of.

If you do strike problems with wow and flutter it is quite unreasonable to rush out and buy a new super-smooth, and probably highly expensive, turntable (although if you're looking for a new turntable anyway, it is worthwhile looking for a model with low levels of wow and flutter). Check out the record first. ●

DEFINITIONS

WOW — the waver of pitch due to undesirable and regular, slow speed fluctuations in the recording medium.

FLUTTER — the waver of pitch due to undesirable speed fluctuations in the recording medium. Occurs at slightly higher frequencies than wow and is heard as a roughening of the sound with a bubbly effect.

Dear Sir,

I am a mechanical Engineering Student, with an unnatural bent towards hi-fi. I also have a Philips 212 Electronic Turntable and have often observed small, regular movements of the tonearm due to either a slightly oversized centre hole on the record, which induces an eccentricity, or (less likely) a slightly non-central hole. (I would like to point out that my turntable doesn't have an undersized centre spindle, because some records - including a DGG - have to be coaxed onto the platter cannot be removed without occasionally lifting the platter and record from the spindle.)

After reasoning that these cyclic arm movements must induce a 'virtual wow' component at 0.56 Hz (33 1/3 rpm) even on an ideal turntable with zero wow and flutter, I did a few calculations (attached) to see if the wow and flutter figures of top turntables and cassette decks were of a similar magnitude to those that would be induced by 'virtual wow' when playing a normal LP record.

The results showed a 'virtual wow' component of 0.05% RMS (at 0.56 Hz) could be expected on a perfect turntable, playing commercial recordings.

This seems to indicate that it is useless to spend extra money to get the wow and flutter below about 0.08%, but of course, a low frequency wow component is subjectively less significant than a high frequency flutter component of similar magnitude, and the weighting necessary to get my 0.05% RMS 'virtual wow' to ?% RMS would probably reduce my 'virtual wow' by so much (because it is all at a very low frequency) as to reintroduce the argument for aiming at wow and flutter figures better than 0.05% WRMS.

I thought that you may be interested as I was to see the sort of figures I came up with.

Yours faithfully,

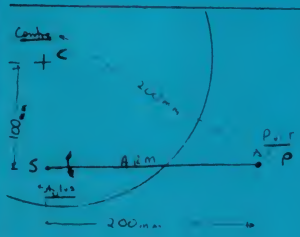
Robert Clark

THE CALCULATIONS

'Virtual Wow' Component Calculations

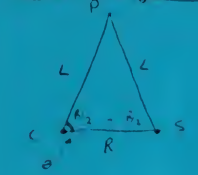
R. CLARK

Notes: 1) Dimensions apply to Philips 212 T/table (approx)
2) Analysis is only 'order of Magnitude', hence can be taken to apply generally to all turntables, as arm dimensions do not vary greatly.
3) Analysis taken at radius of 100mm, which corresponds approximately to ½ way through one side of a typical LP (Virtual Wow components will be decreased near centre)



Data: Pivot to Centre (rad) = 200mm = L
Pivot to Ctg = 200mm = L
Centre to Ctg = 100mm = R
Typical eccentricity (measured) = 0.5mm Peak to Peak (max)

Consider Triangle CPS



$\Rightarrow \cos\theta = R/2L \Rightarrow \sin\theta \frac{d\theta}{dt} = \frac{dR/dt}{2L}$

Induced Wow velocity component = $R\frac{d\theta}{dt}$ (tangential direction)

also $R = \bar{R} + e\sin\omega t$

where e = eccentricity amplitude
$\bar{R}$ = worst mean Radius
ω = Rotational speed of LP in radians/sec

$\Rightarrow \frac{dR}{dt} = e\omega\cos\omega t$

Hence $\frac{\text{Induced Wow velocity}}{\text{Mean Velocity}} = \frac{R\,d\theta/dt}{R\omega} = \frac{R\,dR/dt}{2L\sin\theta} \Big/ R\omega$

$= \frac{Re\omega\cos\omega t}{\sin\theta 2LR\omega} = \frac{e}{2L\sin\theta}\cos\omega t$

Hence RMS value = $\frac{e}{\sqrt{2}\cdot 2L\sin\theta} \times 100$ %

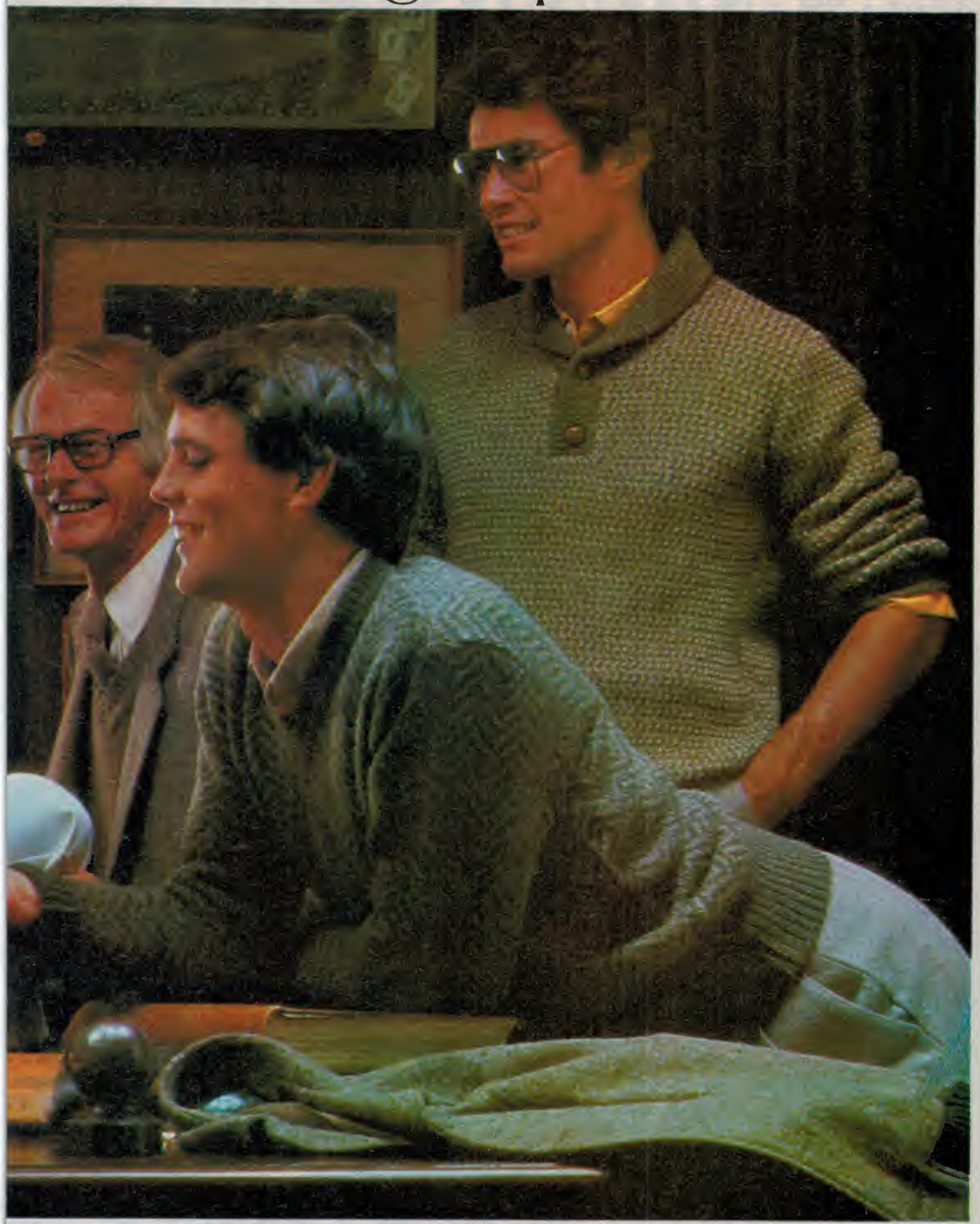
Substituting Values: $L = 200$mm, $e = .5/2 = .25$mm

$\theta = \arccos\frac{R}{2L} = \arccos\frac{100}{400} = 75.5°$

$\Rightarrow$ Induced Wow $= \frac{.25}{\sqrt{2}\cdot 2\cdot 200\cdot\sin 75.5} \times 100 = 0.046$ i.e. 0.05% RMS at 0.56 Hz

Winning the Woolmark.

It's like making the first eleven.



The Woolmark doesn't mean just 'wool'.
It means pure, new wool of a quality so high, it can satisfy a very tough team of selectors.
They give it a mean test:
No fading, bagging or shrinking in the field.
No slipping at the seams.
Keeping a firm crease.
Great natural elasticity and bounce, with a quick return of fibre when stressed.
The ability to take the punishment of at least 20,000 rubs.
The ability to absorb body moisture, yet to shake off outside water...
Only wool with the greatest natural talent makes the grade.
Look for the Woolmark with your favourite label.
It's your guarantee of a successful partnership, season after season.

PURE NEW WOOL

Only wool has natural talent

LBV 1372

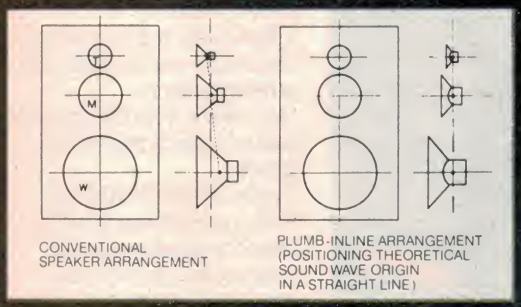
Sony gives it to you straight

When the Sony engineers developed the three-way range of speaker systems they did so with one simple principle in mind.

The end result must be as close to the original programme source as possible.

And as one might expect, Sony have come up with the answer. And Sony's unique answer was the Plumb-Inline speaker arrangement.

Quite simply it means that each speaker unit is aligned so that its sound wave origins, rather than its front edges, are at an equidistant point from the listener.



CONVENTIONAL SPEAKER ARRANGEMENT

PLUMB-INLINE ARRANGEMENT (POSITIONING THEORETICAL SOUND WAVE ORIGIN IN A STRAIGHT LINE)

As you would expect from Sony, the results are superb. Frequency response across the entire audible range is smooth, stereo imaging and presence are improved and sound is clear and transparent.

In fact Plumb-Inline is only one of the many features of the Sony three-way speaker system.

It also features the A.G. (Accoustical Grooved) Baffle Board.

The baffle board has great influence on sound, especially in the mid-to-high frequency range. It not only weakens presence, but makes musical instruments and vocalists fuzzy. Sony's A.G. board effectively works at eliminating such influences, clearing sound and improving presence.

As a further development the system also features Computer-Assisted Design.

Here the Woofer, Mid-range and Tweeter Driver have each been designed based upon repeated listening tests and through the application of NASTRAN – a computer programme originally developed for the U.S. space programme and first used in the Apollo Project for studying vibration patterns under rapidly changing stress conditions.

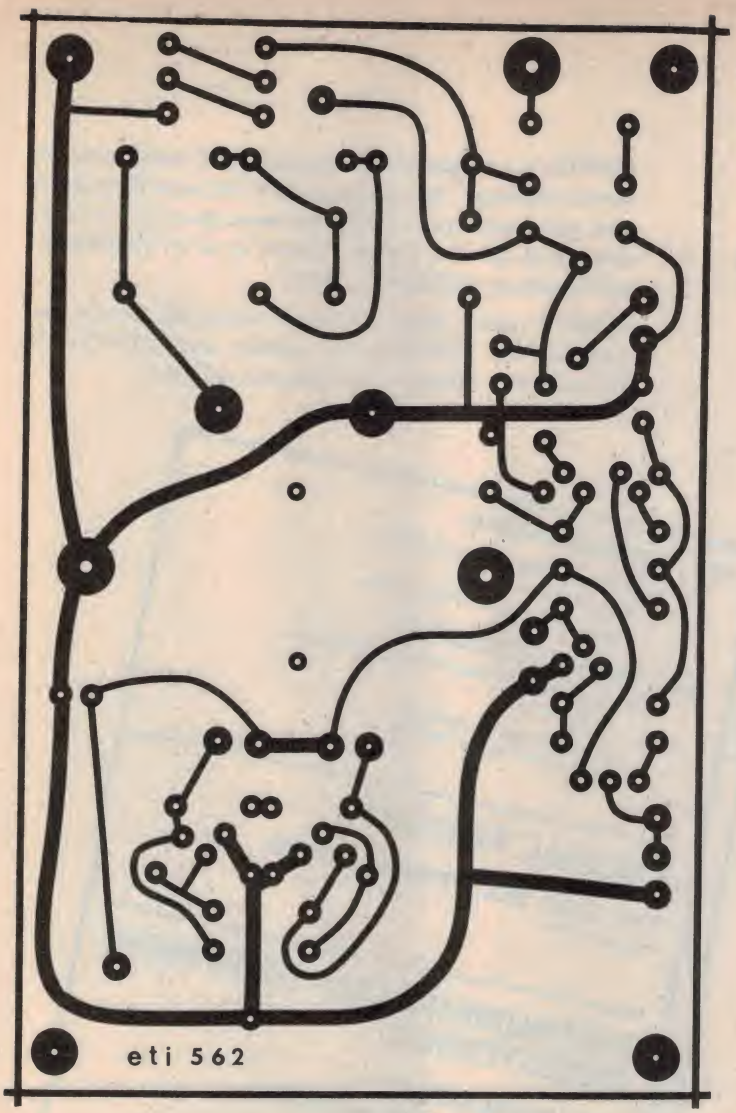
These very real technical advances result in greater reality and presence through the reproduction of magnificent natural sound. Which is why people choose Sony in the first place.

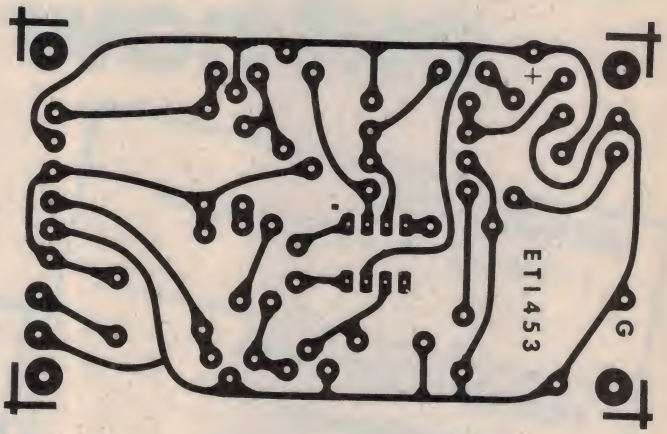
Sony G-series and V-series speaker systems are available from around $300 to just under $900 each.

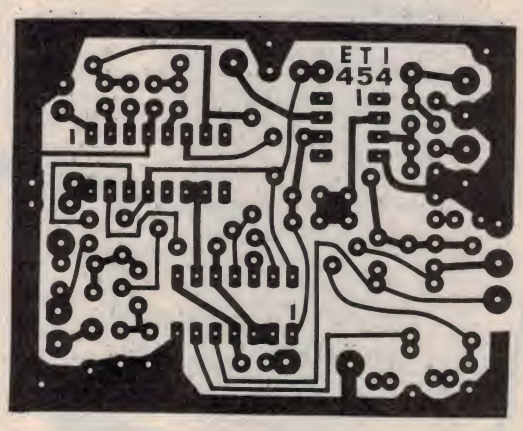
SONY®
AUDIO

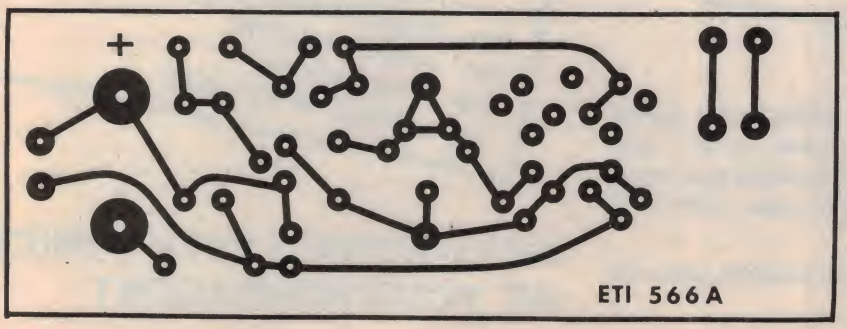
AP 3255

PCB's









Instructions on how to make your own pc boards using the Scotchcal method and exposing through this page may be found on page 113 of the March '80 issue.

SONICS —out now

SONICS is a magazine for musicians and road crews, for sound engineers, lighting operators and recording engineers, for service technicians and venue managers, and for anyone at all who has an interest in or an involvement with music or musical electronics.

SONICS covers every aspect of sound production and presentation, from pick-ups, guitars and amplifiers to microphones, mixers and multitrack recorders.

The first edition of SONICS contains feature articles on a variety of topics, plus a comprehensive Directory — a guide to the "tools of the trade" in the form of a survey of every electric/electronic instrument or piece of equipment SONICS could track down: what it is, where to get it, and what it will cost.

SONICS is a music magazine with a difference — a magazine about the marriage of music and technology.

RENDEZVOUS WITH SONICS AT YOUR NEWSAGENT

Fitting an MC20 cartridge to the J.H. Formula IV tone-arm

The story of how one reader overcame the obstacles of attaching a good moving-coil cartridge to an arm originally designed to take a moving-magnet type — and discovered new depths in his sound system.

Peter Good

WHEN I purchased my J.H. Formula IV tone-arm I resigned myself to never buying a moving-coil cartridge. Twelve months later however, when in the market for a new cartridge, and after reading the myriad reviews available, I found myself seriously considering that previously outlawed breed of cartridges, the main reason being that I'd heard for myself the difference between a Supex and my own moving magnet.

I purchased an Ortofon MC20 and installed it in the J.H. arm which I had mounted on my Thorens TD160 MkII. This was done on the basis of three separate stimuli:

a) John Wright's reviews of the SL20E and MC20 in Gramophone. (Manager of IMF speakers — makers of my own, the super compacts);
b) Your own reviews;
c) Most importantly, my own listening.

I'm not writing this to describe the virtues of moving-coil cartridges, but rather to note the problems I had with mine and how I solved them for the J.H. arm. I suspect that many people own a J.H. and may have been unwilling to install a moving-coil, or disappointed with the results owing to its extreme low mass and flexible headshell.

The problems noted with the MC20 were:

a) Lack of bass extension;
b) Soft and flabby bass, lacking in detail;
c) Average to poor low frequency tracking.

The cures I reasoned were:

i) A more rigid headshell;
ii) More mass to suit the MC20's low compliance.

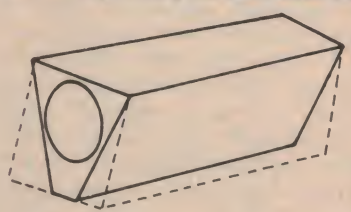
I had previously experimented with the moving-mass of the J.H. arm by adding plasticene to the headshell and re-balancing, but the results were not good enough. After a lot of different ideas had proved improbable or impossible, I settled on making a magnesium headshell, fashioned from the old one (only covering the whole of the cartridge's surface) and attaching this to an aluminium block which in turn could be attached to the arm tube.

A small sheet of magnesium alloy was obtained from a friend, along with a piece of aluminium 10 x 10 x 20 mm with a 6 mm hole drilled exactly down the centre. From the magnesium sheet was cut the headshell (really only a flat sheet).

To facilitate positioning etc, the old one was placed over it to provide rough positions for the holes and overhand adjustments etc.

I cut the aluminium block down to the shape shown in the diagram using a fret saw. This reduced the mass somewhat as the complete block was a little too heavy at 8 gm on its own. The ▶

Above: how I revamped the headshell
Below: cutting/drilling the aluminium block



The revamped tone arm assembly mounted on my Thorens TD160 Mk II turntable

mass of shell and block worked out to just over 6 gm in the end. The plastic headshell weight was about 1 gm so I computed an addition of 5 gm or so to the moving mass, (probably a little more since the counter weight was moved back), but just about the amount that I was after – see 'Note'.

Araldite was used to attach the shell to the block (after both surfaces were scoured). Overhang adjustments were carried out, the cartridge holes drilled and all the other tedious but essential adjustments made while glueing the block finally to the arm (the nervous point of no return). The home reconstructor should sit down and write out all the essential parameters that the new headshell must fulfill in order that overhang tracking error, distance between cartridge top and arm tube, that angles are correct all round (i.e: shell to steel pivot are perpendicular and shell to arm tube are parallel) so that the set-up sites the cartridge in exactly the same place as the original headshell.

The aesthetic appearance of the final product depends largely on what sort of tools you have access to. I used only the most basic of tools, small files and a fret saw. Consequently the finish is not of a professional class – a bench grinder etc, could have solved that problem though. What is most important is that it's rigid, infinitely more so than the J.H. one, and provides a solid platform from which the MC20 or any other moving coil can operate effectively.

By the way there *was* an improvement in sound in all the areas I expected. One improvement I didn't expect was in stereo imagery – an added bonus!

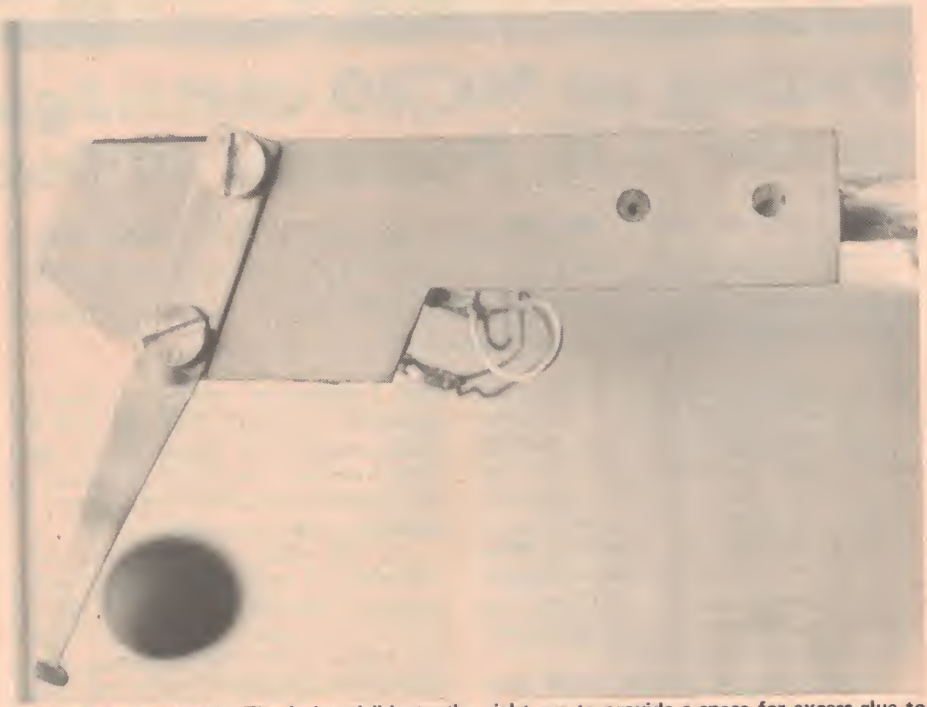
This improvement was carried out following a basic premise that applies to all disc playing systems – you can't discount physics. A turntable is a mechanical environment, dependant on the physical construction of its parts to perform the required function. The duty of the designer (or the enthusiast) is to recognise those requirements and maximise the turntable's chances of performing its function.

The remodelling of the headshell locked up a circle; the circle through record, mat, platter, suspension system, arm base, arm tube, headshell to cartridge and back to record again. This circle must be kept as rigid as possible.

Other ways in which I have strengthened this circle are:

1) By replacing the Thorens moulded soft plastic arm base with a thick piece of perspex, supported by metal spacers and strong screws.
2) The Thorens mat was discarded as soon as possible.

After trying many experiments with plasticene mats and antistatic felt ones, I decided to buy a heavy commercial one. On discovering the price I redecided and for $3.20, bought one square foot of 5 mm thick red natural rubber from Clark Rubber. After cutting it out, I rounded the edges off and sanded out the centre where the label sits. This enabled the record to come in complete contact with the mat and damped it ▶



View of the headshell. The holes visible to the right are to provide a space for excess glue to escape.

Another view of the headshell assembly, showing the aluminium mounting block. Araldite provides an exceptionally strong bond between the different surfaces.

This tuner won't be outdated in the year 2000!

The year 2000 is only twenty years away.

And by then, there could be as many FM stations on air as there are AM ones now.

Some tuners you could buy today won't be able to keep the stations apart.

Some tuners don't have the selectivity.

Yamaha's T-1 has.

Yamaha's T-1 AM/FM Stereo Tuner has such advanced circuitry that there's only one other tuner today that can claim similar features.

And that's made by Yamaha, too.

For instance, the usual way to cancel interference is to switch in a filter.

But then you lose part of the signal.

Yamaha have auto DX — to cancel interference automatically, without filters. Instead, it narrows the bandwidth, 'squeezing' the unwanted noises off air. But the signal you hear remains crystal-clear.

For people who prefer to do it the hard way, it is possible to switch out the auto function and fine-tune the signal yourself.

Another Yamaha exclusive feature is the Tracking-type Pilot signal pure canceller. This functions automatically, to ensure that if the pilot tone wanders, as it often does, it gets cancelled out before it becomes audible.

There are few pieces of hi-fi equipment you can buy today without the risk that something will come along and you'll have to trade up in five or ten years.

With the Yamaha T-1 you don't have to worry.

You've got the famous Yamaha 5-year warranty to protect all the parts.

And as for something more advanced taking over, it could be twenty years before the others catch up.

Yamaha T-1 Natural Sound AM/FM Stereo Tuner available from selected dealers.

YAMAHA

RM 1226/E

superbly – it's also very easy to clean and weighs about 500 grams. So much for rigidity. The mat's main characteristics are those of damping. Damping enables the turntable to operate with some freedom from its hampering environment – the feedback from speakers and other structural sources needs to be filtered by a sub-chassis construction and damped by adding mass to a rigid plinth.

The Thorens plinth is reasonably well made but rather light, (picking up a Linn-Sondek or tapping the side of it reveals some of the clues to its freedom from feedback). Adding lots of plasticene and several kilograms of lead shot to the inside of the plinth can help any turntable resist vibration – it certainly helped mine.

The masonite bottom was removed and substituted with 13 mm particle board to strengthen the plinth structurally. I suppose it all goes to show that you don't have to spend a fortune on good quality hi-fi to turn it into something a lot better.

The improvements I have noticed satisfy *me* immensely. I can only urge other people to think seriously of the disc playing system and how it operates. People with badly designed turntables, sitting on flimsy shelves a few centimetres from their speakers, often blame their system quite unjustly for the horrendous sounds that are produced. Music is what we're after and it's all in the record groove. If it can be extracted without losing any of it or adding anything else, then half the job is done. ●

Further view of the headshell assembly, showing the cartridge mounting.

A new perspex base was fitted to the J.H. tone arm mount, providing quite a rigid support.

MY SOUND is a feature dealing with readers' experiences in setting up hi-fi or other audio gear, readers' solutions to problems with sound systems etc, experimental techniques etc. We are always interested in receiving contributions for this feature and will pay for all items published.

Note:

Resonance frequency of stylus/arm/cartridge interface

$$f = \sqrt{\frac{25330}{MC}}$$

Low frequency resonance of MC20 in SMEIII = 15 Hz

Approximate moving mass of MC20 + SMEIII
= 7gm (MC20) + 5 gm (SME) + 1 gm bolts etc)
= 13 gm (only 1 gm more than that of the J.H. Formula IV)

Thus, compliance = (dynamic) of MC20 $\frac{25330}{13 \times 225}$ ~ 9 c.u.

Approximate moving mass of reconstructed J.H. arm = 3 gm (old mass – 1 gm for plastic headshell) + 7 gm (MC20) + 8.5 gm (mass of block, shell, bolts, etc)
= 18.5 gm

Thus
$$f = \sqrt{\frac{25330}{18.5 \times 9}} \sim 12.3 \text{ Hz}$$

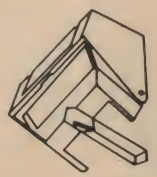
These figures and calculations cannot be taken at face value of course. The HFNRR test which the compliance figure of 9 c.u. is based on could well be unrepresentative of *music* playing on a disc. The calculations do however show that for the MC20's low compliance and the reconstructed J.H.'s additional mass the resonance is lowered towards the 10 Hz ideal – from about 15 Hz to 12 Hz.

This figure satisfies me as any more mass added to the J.H. arm would not only lower the resonance further but introduce new problems of warp/cartridge clearance etc. The moving mass would have to be 27.7 gm in fact – a totally unacceptable figure and no longer a "low mass" arm as Ortofon recommend.

(c.f.:- Hi-Fi News & Record Review, Aug. 1978
Hi-Fi News & Record Review, Aug. 1977)

fact:
a Genuine Shure upgrade stylus is unquestionably the biggest bargain in hi-fi

We strongly urge you to check your stylus for wear at least once a year to protect your records and maintain the highest standards of listening pleasure. Regardless of when (or where) you purchased your Shure cartridge, there is a Genuine Shure replacement stylus available which will bring your cartridge right back to its original specifications. Even better, *you may actually be able to improve its performance significantly over the original* with a Genuine Shure upgrade stylus... at surprisingly low cost! For example:

IF YOU OWN:	UPGRADE WITH:	THIS IS THE RESULT:
 V15 Type III SERIES	**VN35HE** Hyperelliptical stylus 	A dramatic reduction of harmonic and intermodulation distortion (formerly available only to owners of the incomparable V15 Type IV) is now possible with the V15 Type III and the M95 Series of cartridges simply by replacing the stylus. The Hyperelliptical stylus configuration contacts the record groove in a "footprint" that is longer and narrower than the popular Biradial tip design, making it pre-eminent for reproduction of the stereo-cut groove.
 M95 SERIES	**N95HE*** Hyperelliptical stylus 	
 M70 SERIES	**N72EJ** Biradial (Elliptical) stylus **N72B** Spherical stylus 	Improved trackability, especially at high frequencies, due to a new, redesigned low-mass N72 stylus assembly.
ANY M91, M92, M93	**N91ED*** stylus	Much improved trackability due to the lower effective tip mass of the nude Biradial (Elliptical) stylus tip. Less tracing distortion compared with a Spherical stylus tip.
ANY M71, M73, M75	**N75 TYPE 2*** Series styli	Improved trackability at higher frequencies due to a stylus assembly with a lower effective tip mass.
ANY M44 Series	**N55E*** stylus	Lower tracking force with a Biradial (Elliptical) stylus, lower distortion, lower effective tip mass.
M3D, M7D	**N21D*** stylus	Improved performance at lower tracking forces.

***Before purchasing any replacement stylus be certain your turntable is compatible with the tracking force of the stylus you select.**

Always insist on a Genuine Shure replacement stylus. Look for the name "Shure" on the stylus grip.

Genuine Shure upgrade styli by

® SHURE ®

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MILTON 4064 Qld.

ATHOL M. HILL P/L
33 Wittenoom Street,
EAST PERTH 6000 W.A.

AG143/FP

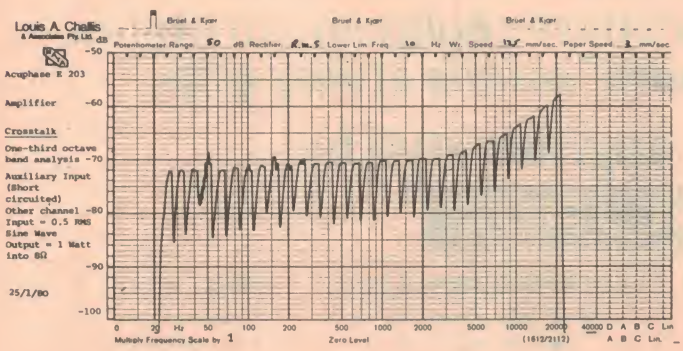
The Accuphase E-203 stereo amplifier

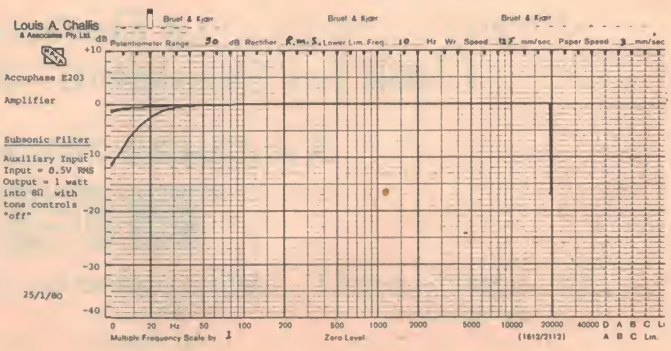
THE ACCUPHASE E-203 is a small brother of the E-303 that we reviewed in August 1979. With a power of approximately half the E303 one could be forgiven for thinking that this is a cheap version of the illustrious big brother. The designers, however may have dropped out a few of the frills but it soon becomes apparent that the E203 has most of the attributes of big brother in a much smaller and neater package, which as such would be more attractive to the majority of intending purchasers.

Features

This unit contains four features that many other expensive amplifiers do not offer. The first is its use of power MOSFETS in the power output stage. The second is that it incorporates an integral low-pass filter to allow direct connection to a subwoofer loudspeaker system. The third being provision of selectable turnover frequencies for bass and treble tone control circuits, whilst the fourth is a circuit design with direct coupling nearly all the way from input to output.

The front escutcheon is of golden-hued, brushed satin aluminium with two tiers of controls. In the top layer is a control switch for two speaker systems. The bass and treble controls flank the tone control turnover selector switches with corner frequencies of 200 Hz and 500 Hz for the base control, 200 Hz and





7 kHz for treble control and a defeat switch in the middle.

The input selector provides for connection of a moving coil cartridge, a moving magnet cartridge, tuner and auxiliary input. Adjacent to this is a 20 dB mute switch. At the right hand side of the escutcheon is a large and sensibly sized volume control. In the bottom tier of controls is a push button power switch, a head phone socket, a subsonic filter (which rolls over at 17 Hz at 12 dB per octave) and a mono switch for interconnecting both channels. Two different stages of loudness control are provided by two selector switches as well as a loudness control defeat switch.

Four tape selector switches are provided. These are a red source monitor switch with black switches for monitor tape recorder 1, monitor tape recorder 2, and copy from tape recorder 1 to tape recorder 2. In the same row, but immediately below the input selector switch, are three push buttons for selecting input impedances of the moving magnet cartridge. The impedance input values provided are 100 ohms, 47k ohms and 100k ohms. The last control on the front is a slider balance control which is sensibly placed immediately below the volume control.

The overall impression of the front panel, its controls and their appearance is of neat functionality with considerable thought having been given to logical layout and ease of usage. The rear of the amplifier has well spaced, clearly designated input and output connections by means of standard co-axial sockets. The moving coil inputs are provided with shorting plugs to reduce the risk of an unterminated input causing overload as a result of spurious pickup.

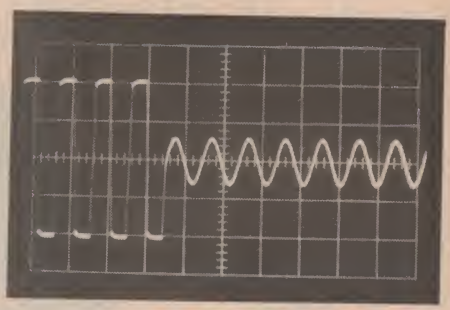
The pre-amplifier output/main amplifier input sockets are linked internally through the use of an interconnection switch and the spring loaded terminations for connecting the two speaker systems are sensibly designed with larger than normal plastic insulated wells. These significantly reduce the risk of short-circuiting the speaker leads. Immediately below the speaker output connections is a coaxial socket for feeding the subwoofer amplifier. This has a switch by which a low pass filter network with cut off frequencies of 50 Hz, 70 Hz and 100 Hz may be selected. The mains power connection to the unit is by means of an IEC panel socket and a standard IEC lead.

Whilst the external cover is of solidly constructed steel having an unusually large expanse of perforations to provide good ventilation, on opening up the amplifier one finds an additional sub-cover of 1.2 mm. steel. This is screwed to the main side rails of the chassis. This sub-cover also incorporates large venting apertures to provide for air flow, and to provide access to the main fuse, mains voltage selector and the central main earth bus bar.

Whilst not anticipating this form of construction, this cover, together with a number of internal isolating sectional covers, do provide a sensible shielding and an effective form of construction and one can readily see that this is no run-of-the-mill amplifier. The electronic circuitry layout and finish is as professional as any we have seen. The designers have incorporated a number of innovative features such as ribbon fed switch connections to facilitate operation of rear mounted switches. This simplifies many of their isolation problems.

On test

I found the objective testing of this unit was particularly pleasing. All of the manufacturers performance claims were



Performance of the Accuphase E203 on transient overload recovery test.

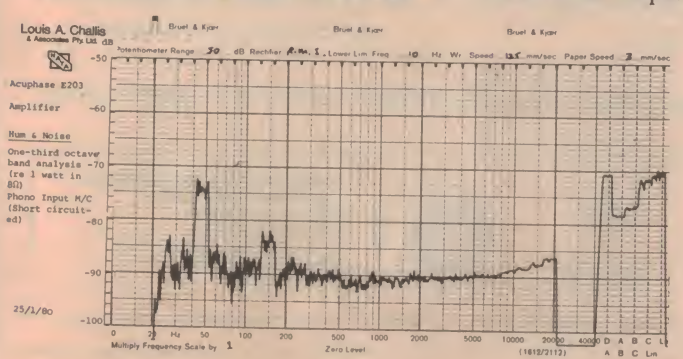
significantly bettered or at least equalled by the unit.

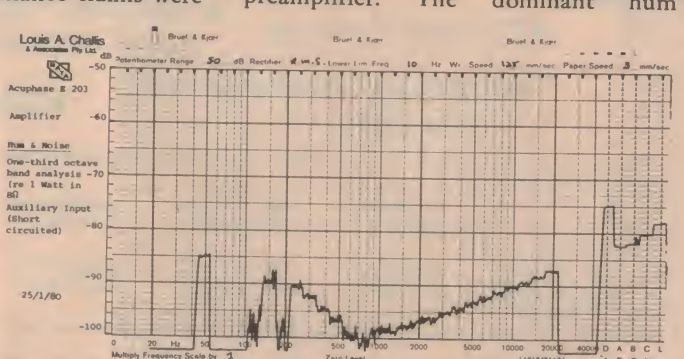
At 70 watts output into 8 ohms the maximum total harmonic distortion that could be measured was 0.006%. At the 1 watt level this distortion only rises to .014% at 100 Hz and is still only .004% at 1 kHz and 6.3 kHz. The maximum power at clipping level is 110 watts with both channels driven. This provides a dynamic head-room of 2 dB relative to the rated power output.

The transient intermodulation distortion is *virtually immeasurable* and is very much less than 0.01%.

The signal to noise ratio, which often separates the best amplifiers from the rest, for this unit is also particularly good with -82 dB(A) at the auxiliary input, -81 db(A) at the moving magnet input and -78 dB(A) at the moving coil input. This performance is not the best we have seen but is still commendable.

The transient overload recovery test showed negligible droop or jitter and the overall performance of the amplifier driven from any input exhibits excellent stability and the equal of any amplifier we have seen. The frequency linearity of the amplifier is impeccable extending from 2 Hz to 200 kHz +0, -3 dB. The 2 Hz lower limit comes as a result of at least one capacitor in the input of each preamplifier. The dominant hum ▶





AKG
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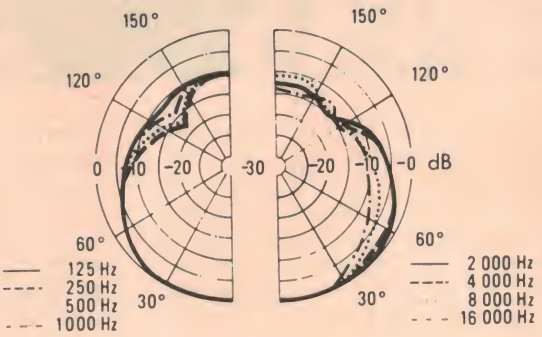
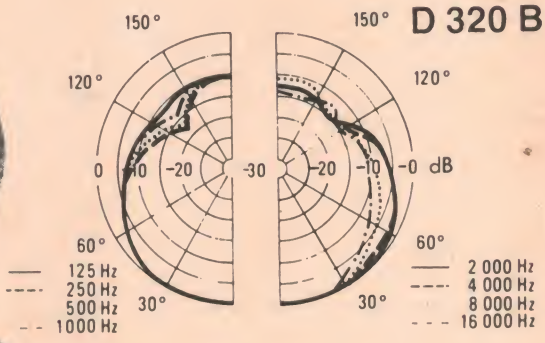
Polar diagram:

D 330 BT



D 320 B



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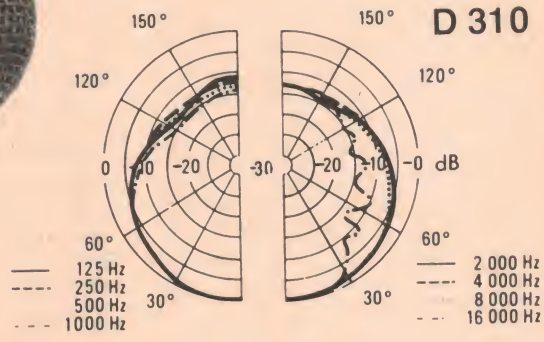

No other "instrument" is more difficult to record or reproduce than the human voice. Each voice is the expression of a person's individuality, and conveys feelings and moods in an infinite variety of audible characteristics.
AKG, who have specialised in the solution of difficult acoustical problems for many years, have released these new microphones which met the stringent requirements of modern day professional musicians and vocalists. The D300 Series incorporates various built-in protective features, because, as accidents do happen (and usually at the wrong time), microphones must be robust to guarantee continuing operation at a studio quality sound.

- Die-cast housing
- Acoustic foam and fitted fabric "pop" windscreen.
- Excellent suppression of handling noise.
- Stainless steel wire mesh outer grille.
- Shockproof internal grille to protect transducer.

AKG

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AWA

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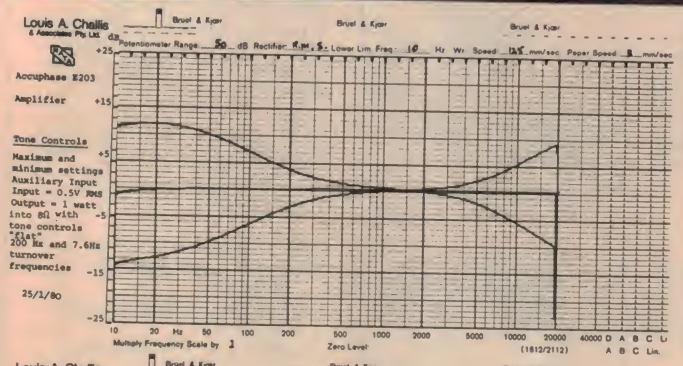

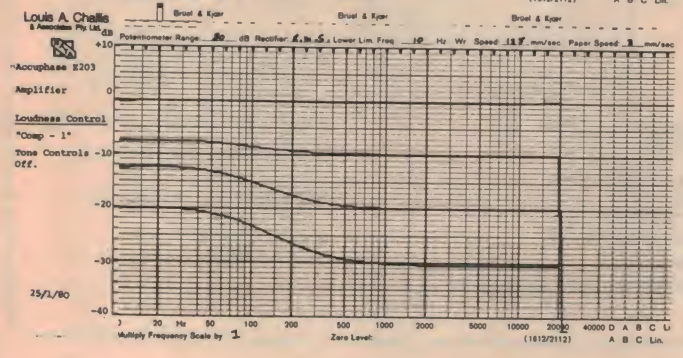

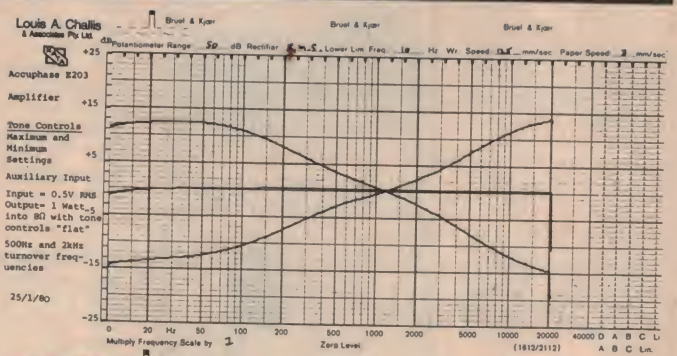

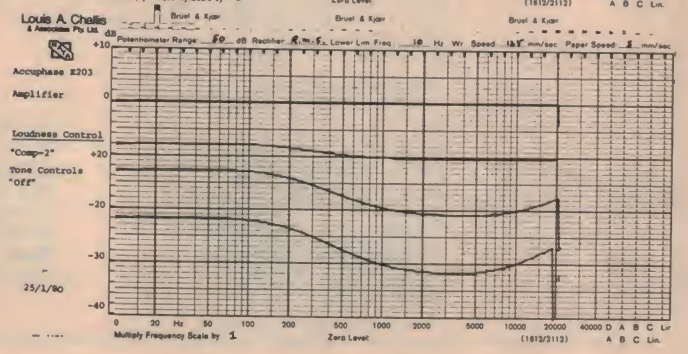

components are evident at 50 Hz but these are -75 dB relative to a 1 watt output in 8 ohms.

To the ear . . .

The subjective testing of this amplifier proved to be exhilirating. With the moving coil input fed by a Nakamichi moving coil cartridge the sound can only be described as transparent with the main outputs fed to two quad electrostatic speakers and the integral subwoofer output feeding a secondary amplifier and JBL K120 subwoofer.

The *breadth and quality of the sound was a revelation*, with no trace of hum or noise, and a rare delight. Replaying many favourite records that we had played with other systems provided a new insight into the depth of their quality and in some cases revealed flaws that we had not previously fully appreciated.

Summary

The Accuphase E-203 is an amplifier which provides adequate power for most users with an almost unrivalled fidelity. The facilities and flexibility go just far enough to satisfy the serious audiophile, without going too far as do some other top-line amplifiers. This is one amplifier that I could safely recommend to anybody and be sure that they would find the results equally as satisfying as I have. ●

ACCUPHASE E-203 INTEGRATED STEREO AMPLIFIER

Dimensions: 445mm wide x 128mm high x 370mm deep
Weight: 14.7 kg *Price: around $900*
Manufactured By: Kensonic Laboratory, Japan

MEASURED PERFORMANCE OF ACCUPHASE E-203 AMPLIFIER SERIAL NO. F9Y003

FREQUENCY RESPONSE: (-3dB re 1 watt, 0.5V Input to Aux.)

Turnover Frequencies
200 Hz/7kHz
500 Hz/2kHz
200 Hz/7kHz
500 Hz/2kHz

SENSITIVITY: (for 1 Watt in 8Ω)

	Left	Right
Aux:	14 mV	14.1 mV
Tuner:	14 mV	14.1 mV
Tape:	14 mV	14.1 mV
Phono M/M:	220 µV	220 µV
Phono M/C:	11 µV	11 µV
Overload M/M:	230 mV	233 mV
Overload M/C:	11.0 mV	11.5 mV

INPUT IMPEDANCE:

	Left	Right
Aux:	41kΩ	40kΩ
Tuner:	41kΩ	40kΩ
Tape:	41kΩ	40kΩ
Phono:	100Ω, 49kΩ, 96kΩ	100Ω, 47kΩ, 100 kΩ

OUTPUT IMPEDANCE: = 145 milliohms (@ 1kHz)

HARMONIC DISTORTION:

(A) (At Rated power of 70 Watts into 8Ω = 23.7 Volts)

	100Hz	1kHz	6.3kHz	
2nd	-86.9	-86.7	-88.8	dB
3rd	-88.2	-100	-89.7	dB
4th	-99.9	-	-	dB
5th	-102	-	-	dB
THD	.006	.005	.005	%

(B) (At 1 Watt into 8Ω)

	100Hz	1kHz	6.3kHz	
2nd	-81.9	-90	-88.4	dB
3rd	-79.5	-92	-94	dB
4th	-89.3	-	-	dB
5th	-92.5	-	-	dB
THD	0.014	0.004	0.004	%

TRANSIENT INTERMODULATION DISTORTION: Less than 0.01%
(3.15kHz square wave and 15 kHz sine wave mixed 4:1)

NOISE & HUM LEVELS:
(re 1 Watt into 8Ω)
(with volume control set for 1 watt output with,
0.5V input (Aux.)
5mV input (Phono M/M
0.5mV input (Phono M/C)

AUX	-78 dB(Lin)	-82 dB(A)
PHONO M/M	-75 dB(Lin)	-81 dB(A)
PHONO M/C	-70 dB(Lin)	-78 dB(A)

MAXIMUM OUTPUT POWER AT CLIPPING POINT:
(IHF -A - 202)
(20mS burst repeated at 500mS intervals)
84 V P-P
110 Watts
Dynamic Headroom = 2.0 dB (re 70 Watts)

Philips introduce their new loudspeakers designed for the 80's

High power - High fidelity to Din 45 500

Introducing the new range of Philips loudspeakers, developed out of 50 years experience in loudspeaker research and production. Select now from our wide range of fine quality, high performance Woofers, tweeters and squawkers. To get more information, talk to your nearest Philips distributor or dealer, or write to Philips direct at P.O. Box 50, Lane Cove, N.S.W. 2066.

Tweeters — 25 mm Dome High Power
Incisive AD 0140/T8 40W RMS Polycarb Non Exposed Dome
Incisive AD 0162/T8 or T1550W RMS Polycarb Non Exposed Dome
New Smooth AD 01605/T8 50W RMS Textile Exposed Dome
New Smooth AD 01631/T8 50W RMS Textile Non Exposed Dome

Woofers — 300 mm High Power.
New AD 12650/W8 60W RMS
New AD 12200/W8 80W RMS
New AD 12250/W8 100W RMS

Squawkers — High Power
AD 5060/SQ8 40W RMS 125 mm Cone Sealed Back
AD 0210/SQ8 60W RMS 50 mm Dome Sealed Back
New AD 02160/SQ8 80W RMS 50 mm Dome Sealed Back

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• these & other drivers; • recommended enclosure designs from 10W-100W RMS; • loudspeaker kits.

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PHILIPS **Electronic Components and Materials**

PHILIPS

AHEARNEL21

Marantz model 2600 stereo receiver

Big, bold, brassy and packed with features. ". . . a specific case where good money can buy a special type of value."

OVER THE LAST 10 YEARS we have seen the value of output powers of FM receivers from a modest 70 W per channel up to 300 W per channel into a 8 ohm load. The Marantz Model 2600 Stereo AM/FM Receiver is immodest not only in performance but also in appearance. This unit which was obviously designed in America for an American market and is packed with features which most Americans would love and possibly even a few Australians as well.

We had previously seen the Marantz Model 2500 which we thought was powerful enough (250 W into 8 ohms) but the Marantz Model 2600 even surpasses that unit. The most striking feature of this receiver is not its size and weight but rather its front panel treatment which we find rather garish and a trifle brash.

The unit

The front panel is divided into four basic sections. The top section contains a cathode ray oscilloscope on the left hand side. This is flanked on the right by an illuminated slide rule dial covering the range 88 MHz to 108 MHz for the FM and 510 kHz to 1700 kHz for the AM bands.

Immediately below the slide rule dial are a series of nine light emitting diodes to indicate the selection of AM, FM, Phono 1, Phono 2, Auxiliary, Tape overload, Tape signal on left to right channel and the frequency lock mode of the receiver. This last light is activated when the quartz locking circuit takes over from the electronic gyro touch tuning control. This control is a neat piece of electronic wizardry which allows the user to tune close to a station and upon lifting one's finger from the knurled tuning wheel the receiver then electronically steps the control to the exact frequency. Whilst the average Australian may not be ecstatic about such features, we believe that most Americans would be.

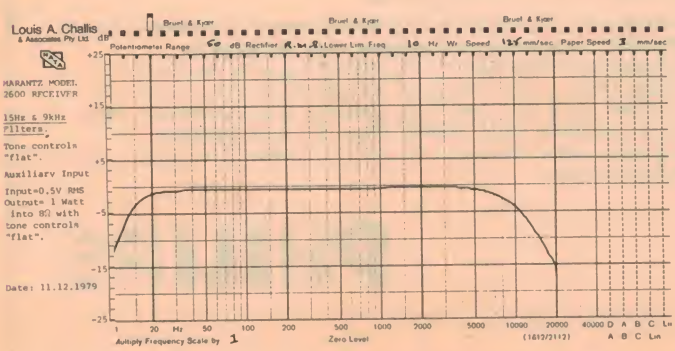
The central line of controls contain push-buttons to copy from Tape 1 to Tape 2, Tape 2 to Tape 1, Monitor Tape 1 or 2, the switch for the cathode ray oscilloscope, the monitoring audio display, the RF tuning display or the multipath characteristics of the RF signal. The other controls are a slide control for adjusting balance, switches for activating the low cut filter for 15 Hz, high cut filter at 9 kHz, a loudness control, multiplex noise filter switch, the muting/quartz control switch for weak stations and two switches for selecting Speaker System 1 and/or 2.

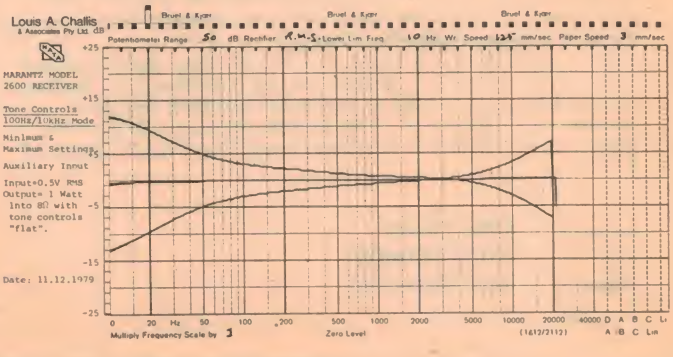
The bottom row of controls feature a pair of sockets for dubbing in and out; selectors for AM/FM Phono and Auxiliary; a mode switch for stereo, reverse, left and right, and left or right; a tone control mode switch for defeating or for selecting the operating filter frequencies; a bass-control, mid-range control and treble control each with separate individual concentric controls for left and right channel and an indented volume control with nominal attentuations engraved around the circumference.

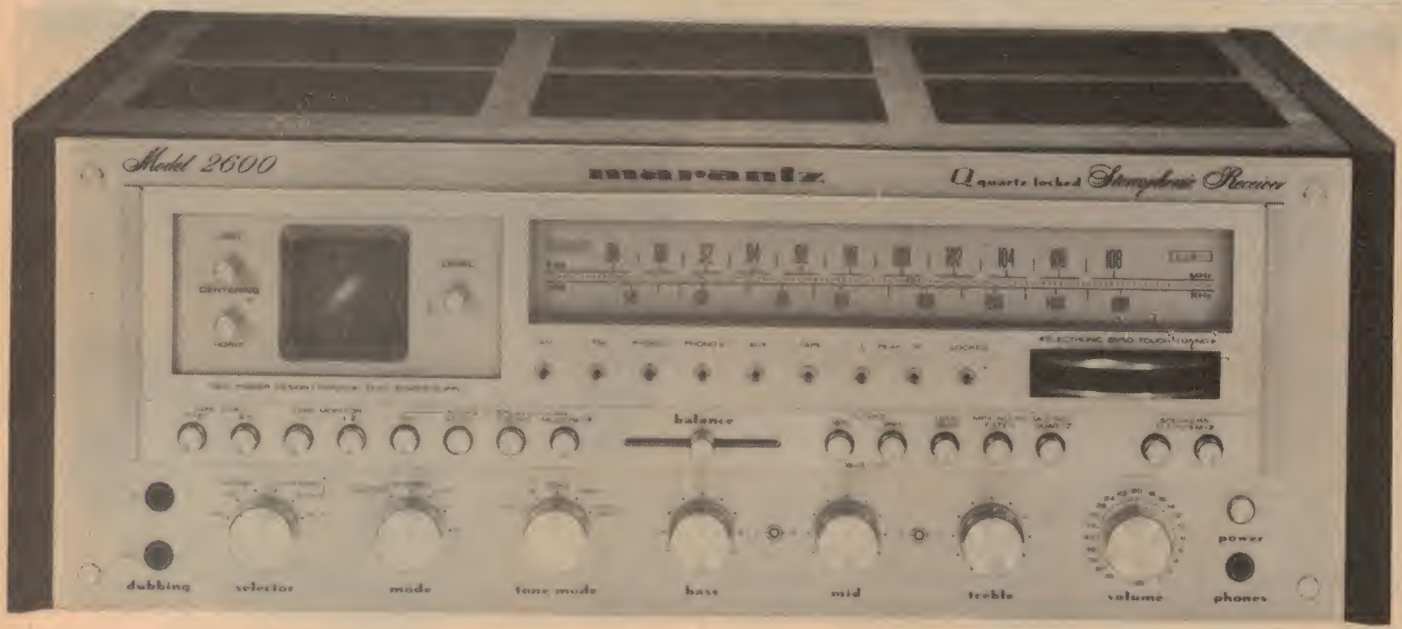
On the extreme right hand side of the bottom of the control panel is the power on/off switch and a tip-ring-and-sleeve headphone socket.

The rear of the unit features two sets of well-designed spring loaded sockets for speaker connections; a small axial cooling fan for extracting the heat from the power amplifiers; a voltage mains fuse plus coaxial and twin feed aerial sockets for 75 ohm, 300 ohm and AM antennas. The unit also incorporates a well-designed external loop stick antenna and coaxial sockets for all the main inputs and output connections.

The inside of the unit looks like a professional piece of studio equipment. The chassis is dominated by a large circular can containing the toroidal power transformer together with the two large filter capacitors. On the right hand side of the unit is a massive, air-cooled output stage block whilst the right hand side is flanked by the neat and effective cathode ray oscilloscope







which the designers have seen fit to incorporate. The unit features a large number of protection features including eight internal fuses as well as automatic relay activated protection circuitry which is effective and, to say the least, essential. The design of the unit is obviously of the highest standard and Marantz have gone to a great deal of trouble to fit a tremendous amount of circuitry and many innovative design features into what must be considered a relatively small package. The unit features a strong steel chassis and first class consumer type components, in a design that is highly professional.

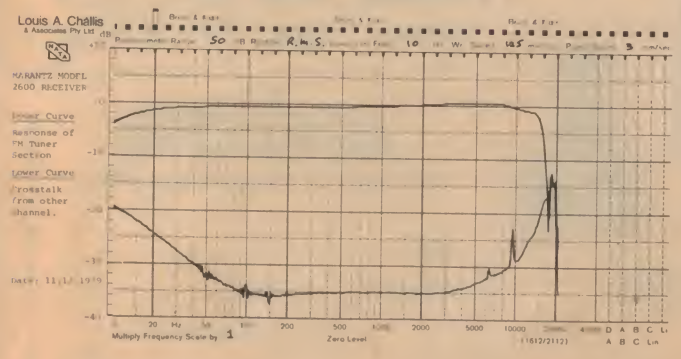
On test

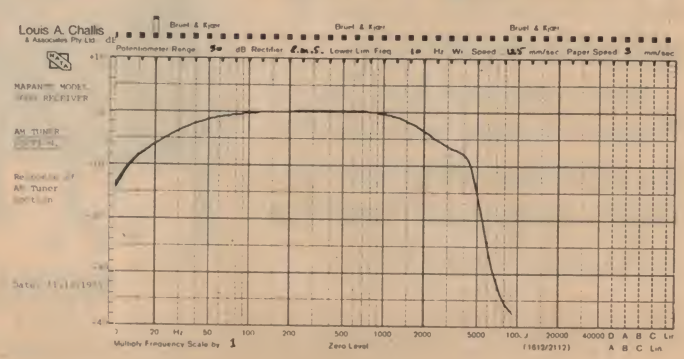
The objective testing of this unit proved to be rewarding. The frequency range extends from 3 Hz to 73 kHz and gratifyingly, the activation of the tone control defeat circuit did not substantially change this. The sensitivities and signal to noise results are exemplary. The harmonic distortion at the 300 kW level is also exemplary, being less than 0.008% at any of the test frequencies whilst at the 1 W level this figure was still less than 0.014% at all test frequencies. The transient intermodulation distortion proved to be impeccable, whilst the hum and noise levels were excellent from both an unweighted and A-weighted standpoint. On the RF side, the FM frequency response and the channel separation were impeccable and even the AM response was reasonably good. The loudness controls worked the way they should. The low frequency, mid frequency and high frequency tone controls functions operated within the correct regions, i.e: the mid frequency was centred at 500 Hz. The crosstalk between channels was impeccable and the hum and noise was also excellent.

The RF sensitivity in the mono mode was 8.75 dBf (1.2 uV). The stereo sensitivity for 50 dB quieting is 33 dBf (25uV). The spurious IF and image rejection was greater than 120 dB and the AM suppression better than 60 dB. The AM tuner sensitivity was 10 microvolts and even its spurious and IF rejection were better than 80dB. The only fault we could find was that the cooling fan was audible and at a level of 25 dB (A) at one metre would detract from quiet listening.

Subjectively

Our subjective evaluation of this unit showed it to be exemplary and we were more impressed by the oscilloscope display which offers one of the best features of any receiver we have yet seen. This is useful for tuning, not so much for strong stations, but is more important for weak stations when the ▶





Not the world's biggest selling turntables.

Southend is the place the British used to go for their holidays before they discovered the sun. It's famous for its mud, whelks and its pier. (Recently they tried to blow up this Victorian marvel. They failed.)

Now Southend has another claim to fame. Roy Gandy! He's a product of that era when 'British really was best'.

"There was an Empire on which the sun never set." And the Japanese hadn't been invented! Not that Roy Gandy is ancient. Quite the reverse. It's just that he thinks that old. For him second best — isn't!

Mr. Gandy's company, Rega, make the Planar turntable. And they make each one painstakingly by hand. Mr. Gandy, being British, is reluctant to discuss his products. The media however are not so reticent.

Adrian Hope, writing in 'Hi-fi for Pleasure' states, "A close inspection of the Planar 3 show that it is constructed to a very high standard". "The most striking feature is the plate glass platter 12mm thick weighing some 4½lbs." "Listening tests proved to be very pleasing."

'Hi-fi Review' agrees. "The Rega Planar 3 delivered a very smooth well balanced sound, free from any obvious colouration." "There can be no argument that the system worked very well indeed."

If you would like to know more about Mr. Gandy's non-mass produced Planar 3 turntable fill in the coupon below. Or call Concept Audio direct.

Rega

Mr. Gandy's Planar 3 turntable sounds exceptional. Tell me more.
Send me the reviews and the name of my nearest stockist.

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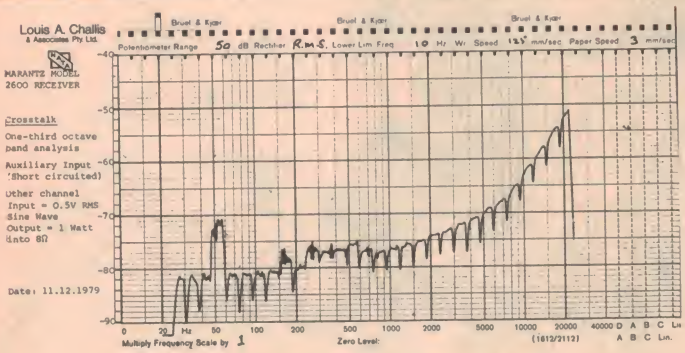
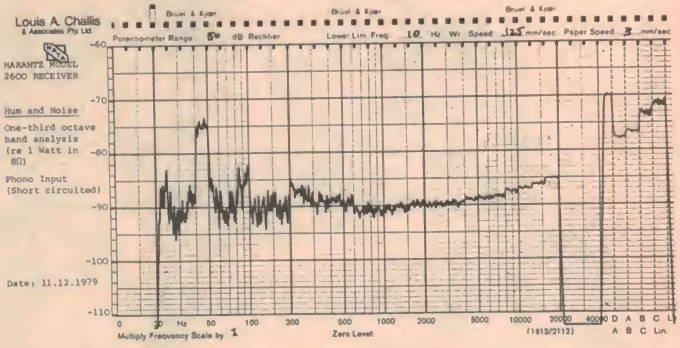




quartz lock function has inadequate signal sensitivity to allow it to operate.

The background noise on FM is extremely low and the background noise on both FM, AM and on record play and tape recorder is almost as good as any amplifier we have tested. Where other manufacturers may have been prepared to sacrifice performance in order to provide the gargantuan power of 300 W per channel, Marantz appears to have sacrificed nothing by way of quality on this unit. Although we are not amoured with the appearance we have more than a grudging respect for the objective and subjective performance that this unit displays. Whilst this unit is obviously not designed for the Australian market, we see no reason why any well heeled Australian would not be impressed by what it does quite apart from how it looks. This unit does not necessarily constitute good value for money but rather, may constitute a specific case where good money can buy a special type of value. ●

THE MARANTZ MODEL 2600 STEREO RECEIVER

Dimensions: 48.9cm wide x 17.8cm high x 43.8cm deep

Weight: 27.5 kg *Price: $1750.*

Manufactured by Marantz (U.S.A.) in Japan

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE
OF MARANTZ MODEL 2600 RECEIVER - S.N. 6X NO. 30019

FREQUENCY RESPONSE (-3dB re 1 Watt, 0.5V Input to Auxiliary)

Tone Controls Centred
Left: 3.3Hz to 73kHz
Right: 3.2Hz to 81kHz

Tone Controls Defeated
Left: 3.0Hz to 74kHz
Right: 3.0Hz to 82kHz

SENSITIVITY (for 1 Watt in 8Ω)

	Left	Right
Aux.:	12mV	12mV
Tuner:	-	-
Tape:	12mV	12mV
Phono:	130µV	140µV
Over-load:	232mV	230mV

INPUT IMPEDANCE (@ 1kHz)

	Left	Right
Aux.	63kΩ	67kΩ
Tuner:	-	-
Tape:	63kΩ	67kΩ
Phono:	61kΩ	53kΩ

OUTPUT IMPEDANCE 90 milliohms (@ 1kHz)

HARMONIC DISTORTION (At Rated power of 300 Watts into 8Ω = 49 Volts)

	100Hz	1kHz	6.3kHz
2nd	-82.8	-85	-84.4 dB
3rd	-93.1	-93.4	-89.5 dB
4th	-100.2	-	- dB
5th	-	-	- dB
THD	*0.008%*	*0.006%*	*0.007%*

HARMONIC DISTORTION (CONT'D) (At 1 Watt into 8Ω)

	100Hz	1kHz	6.3kHz
2nd	-78.6	-82.9	-88.6 dB
3rd	-88.3	-88.1	- dB
4th	-85.8	-	- dB
5th	-90.9	-	- dB
THD	*0.014%*	*0.008%*	*0.004%*

TRANSIENT INTERMODULATION DISTORTION (3.15kHz square wave and 15kHz sine wave mixed 4:1) < 0.1%

NOISE AND HUM LEVELS (re 1 Watt into 8Ω) (with volume control set for 1 Watt output with - 0.5V input (Aux.) 5mV input (Phono))

Aux: -75dB(Lin) -79dB(A)
Phono: -71dB(Lin) -78dB(A)

MAXIMUM OUTPUT POWER AT CLIPPING POINT (IHF-A-202) Greater than 300 Watts

IHF USABLE SENSITIVITY:

FM Section	
8.75dBf	1.2µV

SPURIOUS, IF & IMAGE REJECTION: 120dB

AM SUPPRESION: 60dB

50dB QUIETING: Mono 12.1dBf (2.2µV)
Stereo 33.2dBf (25µV)

Top AMPEX REEL to REEL TAPE at one-third normal price!

The USA Ampex Corporation has made available a substantial quantity of 'off-cut' tapes from their highest grade material. All tapes are 1800 ft (549 m) by ¼", 1 mil ferric oxide on standard 7" reels.

There's a slight gamble involved — but one in which you either win a lot — or a hell of a lot!

Here's why:
The tapes offered are of differing types and you take pot luck on which you receive.

BUT, The lowest quality is Ampex' superb Ampex Plus series! The highest is Ampex' Grand Master series!

SO. If you draw the Ampex Plus' you'll be paying about one-third the usual price. If you score the Grand Masters you'll be paying about a quarter usual price.

YOU CANNOT LOSE. If you are not totally and completely satisfied with your purchase, Dindy guarantee to return the full purchase price without question provided the tapes are returned within 14 days in the original packing.

Identical tapes to those offered are marketed in the USA by Ampex, using the trade name 'Shamrock'. This trade name is also used for those offered here.

NOTE: This offer is made by Dindy Marketing (Aust.) Pty Ltd and this publication is acting as a clearing house only. Cheques should be made payable to 'Ampex Tape Offer' and sent, together with the order form or accompanying letter, to 'Ampex Tape Offer', c/o ETI Magazine, 15 Boundary Street, Rushcutters Bay NSW 2011. We will then process your order and pass it on to Dindy, who will send you the goods. Please allow up to four weeks for delivery.

Owing to the exceptionally low offer price, the minimum ordering quantity is ten tapes (total $39).

$39 for 10 reels

Plus $2.00 for post and packing.

AMPEX TAPE OFFER

Please supply .....tapes at $39 for ten $.....

Plus post and packing, any quantity:— $2.00

TOTAL $.....

Name .....

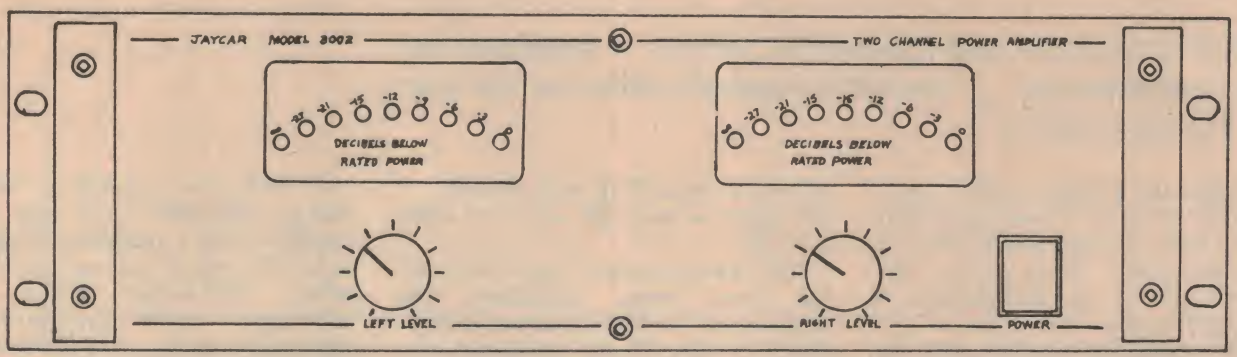
Address.....

.....

.....Post Code .....

NEW STEREO POWER AMPLIFIER NEW

MODEL 3002



Based on ETI's superb new 466 amplifier module, the Jaycar 3002 kit provides high power at a fraction of the cost of comparable commercial units.
LED power meters that give an accurate reading of output power, thermal overload protection and speaker protection against overload and DC voltages have been combined with two ETI 466 modules and a rugged rack mounted case to provide an amplifier that will withstand the tortures of "on the road" use.

FEATURES:
- 300 watts per channel.
- LED power meters.
- Input level controls.
- Massive heatsinking.
- Inbuilt speaker protection.
- Thermal overload protection.
- Rugged rack mounting cabinet with handles.

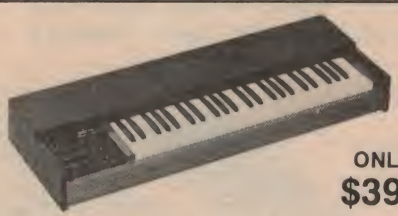
Send S.A.E. for full information and specification sheet.

COMPLETE KIT ONLY **$550**

"CLEF" TS88 Touch Sensitive Piano

This unique 88 note piano is fully touch sensitive and offers 4 selectable piano tonal qualities plus tremelo, honky-tonk and phasing effects. Complete with pedals, this is the best performance piano kit on the market today.

- Full 88 note keyboard.
- Touch sensitive on all voices.
- Sustain and Soft pedals.
- Combination of voices and harpsichord plus electronic effects.
- Small, compact and lightweight.



ONLY **$395**

"CLEF" String Ensemble

Simulates the multiple source sound of string group.
- Split keyboard facility.
- 4 voices on upper keyboard.
- 3 pre-set voices on lower keyboard.
- Variable Attach and Decay.
- Foot controlled Swell pedal.

jaycar PTY. LTD.

380 SUSSEX STREET, SYDNEY

PO Box K39, Haymarket, 2000. Tel: 211-5077.

Yamaha P2200 200W/ch. power amplifier

"... a first class piece of equipment. Whilst ... designed for commercial usage ... it would be equally at home in a true high fidelity system."

THE YAMAHA P2200 amplifier is one of the first pieces of Yamaha gear that we have seen designed specifically for the commercial rather than the consumer market. The first feature of this amplifier that strikes you is the apparent ruggedness and the way the designers have gone to a lot of trouble to enable it to withstand normal abuse, particularly in transit, when used for professional musical applications.

The amplifier is designed with a matt black finish on most surfaces. The front panel has a very rugged appearance with sturdy power on/off switch, and LEDs to indicate thermal overload and power on. These are deeply recessed into the escutcheon to provide better than normal protection. The top section of the panel contains two deeply recessed wattmeters which indicate power into a normal eight ohm load. These are calibrated from 0.01 watt through to 100 watts at zero dB, and 300 watts at +5 dB.

The lower section of the front panel has two rotary, calibrated step attenuators with steps of minus infinity; 50 dB, 42 dB, 37 dB, 34 dB and then 2 dB steps to zero dB. These attenuators are accurate, functionally effective and also rugged.

The front panel of the amplifier is designed for rack mounting in a standard 19" (480 mm) rack and features two large aluminium handles on either side to provide ease of lifting and additional positive protection for the front panel when being moved. The sides of the amplifier incorporate massive heat sinks which are deeply finned and thermally effective.

The top of the amplifier features a heavy, anodised aluminium slotted cover which also provides for effective thermal dissipation. The rear of the amplifier features unbalanced inputs by means of a pair of male and female XLR series professional sockets with unbalanced inputs switchable from either pin 2 or pin 3. In addition, there are tip-and-sleeve sockets immediately below to allow interconnection with tip-and-sleeve leads or with the adjacent channel. The unit is not arranged for automatic paralleling of inputs nor is it wired for balanced inputs which would be preferred in many broadcasting and professional situations.

The mains fuses are sensibly located on the back panel and the speaker terminals are very large universal sockets to simplify rapid connection of the external loads.

The designers have sensibly placed extended feet which double as

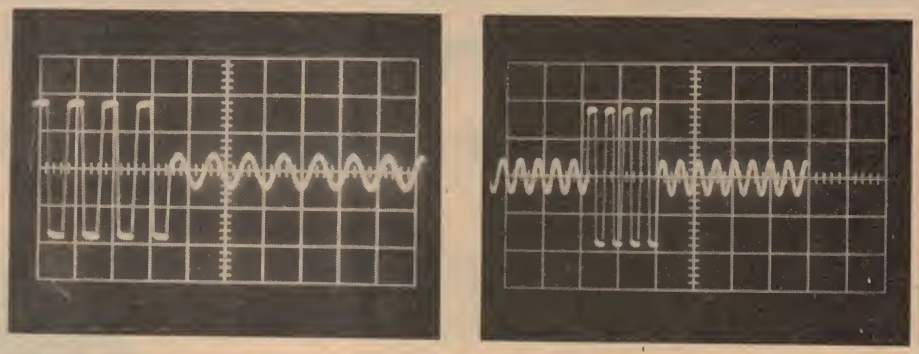
protective buffers on both sides of the rear of the chassis to provide protection for the terminals, wiring and the amplifier itself in transit. The feet provide reasonable clearance for the amplifier when located on a rack, in transit or on a shelf.

Unlike any other professional handbook we have seen, the handbook for this unit has 52 pages of useful data and is a veritable encyclopaedia of good design practise and usage. The data is useful, not only for this amplifier, but also for many of the associated facilities including plugs, cables, and wiring systems with which it could reasonably be expected to be used.

The handbook also provides accurate data on maximum power loads and other pertinent characteristics for the amplifier in use. In particular, it provides data on load impedance versus output power with the data extending down to two ohms. We checked that particular data out and shall have more to say about it later.

On the bench

The objective testing of this unit showed its frequency response to extend from 1½ Hz to beyond 110 kHz and ±½ dB from 20 kHz to 50 kHz. The distortion characteristics of the amplifier are far better than one would expect and are truly "high fidelity", being 0.014% at 100 Hz, 0.003% at 1 kHz and 0.005% at 6.3 kHz at maximum output. At the one watt level this performance was still excellent with the total harmonic distortion being 0.018% at 100 Hz, 0.004% at 1 kHz and 0.007% at 6.3 kHz.



Transient overload recovery test (according to standard IHF-A-202). 10 dB overload re rated power into 8 ohm load, both channels driven. Overload duration — 20 ms, repetition rate — 512 ms. Left picture taken with sweep at 1 ms/div., right picture at 2 ms/div.

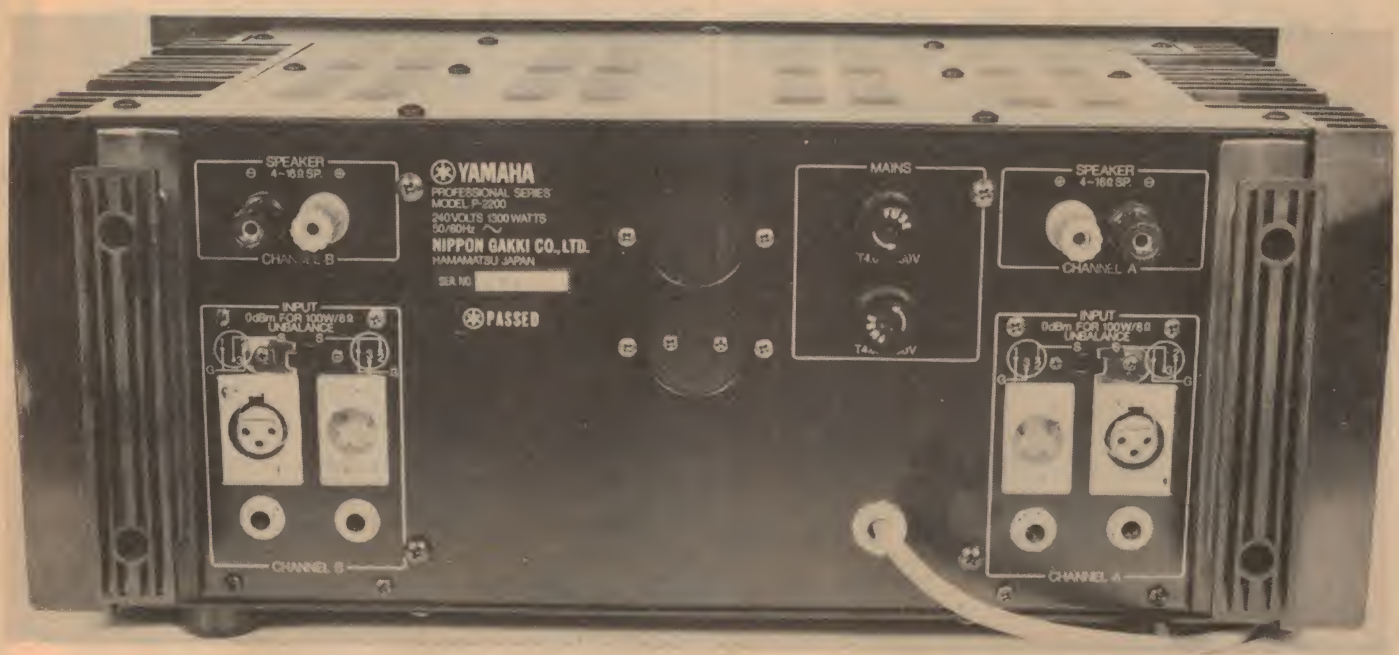
We were intrigued with the stated power output of the unit. The actual maximum power output into a four ohm load was 420 watts, with both channels driven, and 529 watts with one channel driven. At two ohms this power drops to 306 watts and, according to the handbook, the peak power with one channel driven occurs at about 2.5 ohms where 600 watts can be delivered by the amplifier.

The hum and noise level performance is also in the top end of the high fidelity league. The results were excellent being -82 dB linear and -90 dB A-weighted, referenced to the one watt level.

The transient overload performance of the unit is outstanding and the transient intermodulation distortion is less than 0.01%, which is also excellent. The crosstalk (separation) between channels is typically 100 dB at 1 kHz and is better than 83 dB at all frequencies between 20 Hz and 20 kHz.

Listening test

I could not fault the objective testing so I tried out the subjective performance of this unit utilising it as the basis for a public address system at a large charity dinner with a number of top name singers of international repute performing. When fed by four microphones and quality four-channel mixer, ▶



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ALL YOUR REQUIREMENTS AUSTRALIA WIDE

We have everything you need in stage lighting equipment

NEW

REMOTE CONTROL LIGHTING SWITCHBOARD

BY ACCESS ELECTRONICS

This is a remarkable breakthrough in lighting control systems. Many applications do not require a dimmer system, but need a flexible, versatile switching system. This extraordinary system features a 12 circuit stage rack with 12 x 2000W zero switching modules. The stage rack is connected to a remote control desk with a standard 14 core control cable. The desk features 4 presets, each with a master. All 12 channels have a flash-to-full button, as do each of the 4 masters. A programmable chaser offers sequencing over the masters. Each preset switch has an LED indicator, glowing at half brilliance when preset selection is made and full brilliance when that particular preset is in use. The remote switching unit offers versatile control of 12 lighting circuits — without the expense of dimmers.

- RACK MOUNTING STAGE RACK
- 12 x 2000W CIRCUITS
- ZERO SWITCHING
- 4 PRESET CONTROL DESK
- MODULAR SWITCH GEAR
- LED INDICATION
- FLASH BUTTONS
- PROGRAMMABLE CHASER

NEW

OSCILITE CHASER

New, compact light chaser from Page Electronics. Simple operation with variable rate control for three 450W lighting circuits. For shadow chase, simply turn unit over! Perfect for shop displays, disco, promotions. A neat, low-cost unit!

FLIGHT 36 DIMMER DESK

The Flight 36 is a totally new advance in dimmer desks offering 36 channels, 2 presets and A & B masters. Each channel has a flash button, as do each of the masters. A master fader allows dimmer setting of the flash buttons. A push down blackout button is convieniently placed above the masters. Individual selection of each channel to a master is by push switch, with LED indication giving an immediate "state-of-the-board" at one glance. Flight 36 will couple with any standard Strand Electric dimmer rack — Miniset, Minipak and JTM! 1, 2 or 3 12-way dimmer racks may be used, allowing a system to be assembled with potential for future expansion. The Flight 36 interconnects with Strand dimmer racks using a 14 core control cable, with twist-lock cannons. The Flight 36 is a rugged, precision lighting desk, designed for fixed installation or touring.

ROSCOLENE COLOUR FILTERS

The most widely used colour medium throughout the world — available in a full range of 52 standard theatrical colours. Roscolene is clear, easy to handle, stable, with good durability. Sheets — 500mm x 600mm (20" x 24").

LEE FILTERS

This popular English filter medium is available in 47 standard theatrical colours and correction filters. Lee Filter comes in large sheets — 1200mm x 533mm (48" x 21").

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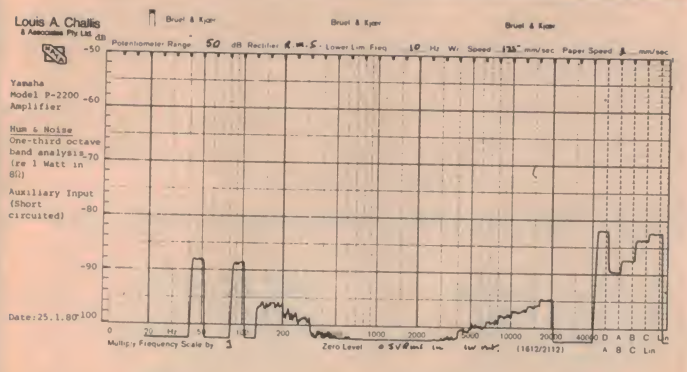
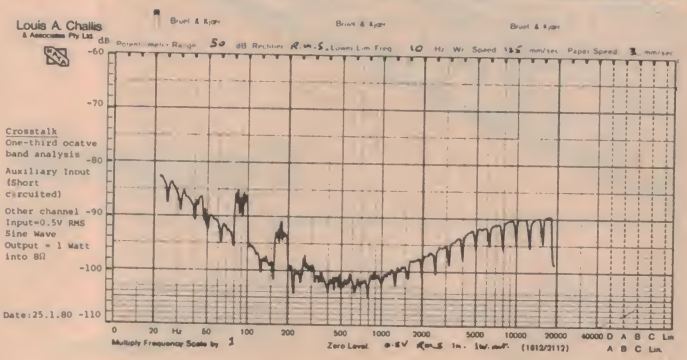




the unit was driven to close to its maximum output on a continuous basis for some three hours. The VU monitors sat happily around the 100 and 150 watt level for most of the time with regular peaks up to the 300 watt level, where the onset of clipping was detectable.

It was quite apparent on the subjective evaluation that clipping or overload is taken in its stride. The amplifier quite happily handled the thermal dissipation without additional fans and with an ambient temperature of 30°C.

The amplifier equitted itself well in this role with no audible trace of hum and gave a scintillating performance.

I evaluated the unit at home, subsequently, in my living room, fed by a Shure V15 cartridge, an AIWA 6900 cassette player and an SAE 3000 preamplifier. The quality of reproduction was as natural as the label on the front panel of the unit claimed it to be.

Summary

The Yamaha P2200 is a first class piece of equipment. Whilst it may have been designed for commercial usage in auditoria, hotels and discos, it would be equally at home in a true high fidelity system.

The only factor limiting its range of uses that I can find is its lack of internal balanced inputs. Even this problem could be readily overcome by means of external transformers or by rewiring the internal circuitry to accept balanced-to-unbalanced transformers with the appropriate changes in labelling on the back panel.

Overall, the Yamaha Model P2200 Amplifier performs much better than it looks! ●

THE YAMAHA MODEL P2200 AMPLIFIER – SERIAL NO. 7300

Dimensions: 480 mm wide x 188 mm high x 380 mm deep

Weight: 20 kg *Price: $1395*

Manufactured by The Yamaha Corporation, Hamamatsu, Japan

MEASURED PERFORMANCE OF

YAMAHA STEREO AMPLIFIER MODEL P-2200 (S.N. 7330)

FREQUENCY RESPONSE:

(-3dB re 1 watt, 0.5V Input to Aux.)

Tone Controls Defeated

Left: 15Hz to > 110kHz

Right: 15Hz to > 110kHz

SENSITIVITY:

(for 1 Watt in 8Ω)

	Left	Right
AUX.	76mV	76mV

INPUT IMPEDANCE:

	Left	Right
AUX.	> 25kΩ	> 25kΩ

OUTPUT IMPEDANCE: = 35 milliohms (@ 1kHz)

HARMONIC DISTORTION:

(A) (At Rated Power of 230 Watts into 8Ω = 42.9 Volts)

	100Hz	1kHz	6.3kHz	
2nd	-80.3	-92.8	-90.2	dB
3rd	-81.3	-92.4	-88.1	dB
4th	-95.7	-	-	dB
5th	-94.9	-	-	dB
THD	0.014	0.003	0.005	%

(B) (At 1 Watt into 8Ω)

	100Hz	1kHz	6.3kHz	
2nd	-77.3	-88	-	dB
3rd	-79.6	-	-83.2	dB
4th	-90.8	-	-	
5th	-90.2	-	-	dB
THD	0.018	0.004	0.007	%

Both channel driven @ 1kHz load 4Ω P = 420W per channel

One channel driven @ 1kHz load 4Ω P = 529W one channel

One channel driven @ 1kHz load 2Ω P = 306W one channel

TRANSIENT INTERMODULATION DISTORTION: Less than 0.01%

(3.15kHz squarewave and 15 kHz sine wave mixed 4:1)

NOISE & HUM LEVELS:

(re 1 Watt into 8Ω) AUX. 82dB (Lin) 90dB(A)

(with volume control set for 1 watt output with, 0.5V input (Aux.)

MAXIMUM OUTPUT POWER AT CLIPPING POINT:

(IHF -A - 202)

(20mS burst repeated at 500mS intervals) 136 V P-P

= 289 Watts

∴ Dynamic Headroom = 1 dB (re 230 Watts)

Number Two ETI CIRCUITS

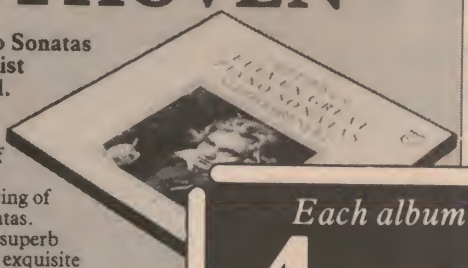
Contents

Please note: the Circuits Books are intended as 'ideas directories' — they are not meant for the beginner.

Enjoy any one of these magnificent album sets for 10 days FREE!

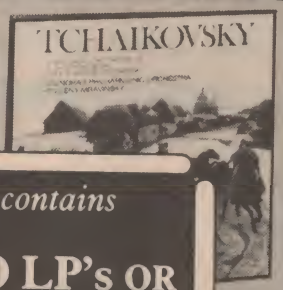
BEETHOVEN

11 Great Piano Sonatas played by pianist Alfred Brendel.



This is a quality Philips edition of some of the most popular and moving of Beethoven's sonatas. Included are the superb 'Pathetique', the exquisite 'Moonlight', the 'Waldstein', the beautiful 'Appassionata' and the mighty and demanding 'Hammerklavier' . . . a real musical feast. Each is played by Alfred Brendel, one of the finest concert pianists playing today.

TCHAIKOVSKY



Symphonies 4, 5 and 6 together with the Swan Lake and Sleeping Beauty Ballet Suites.

The celebrated Deutsche Grammophon edition of Tchaikovsky's three greatest symphonies played by the renowned Leningrad Philharmonic under Yevgeny Mravinsky. Also included are the famous recordings of the Swan Lake and Sleeping Beauty ballet suites by Herbert von Karajan and the Berlin Philharmonic.

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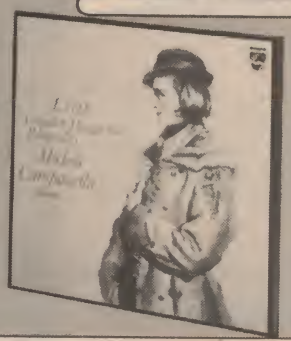
(plus $1.65 delivery, handling and insurance).

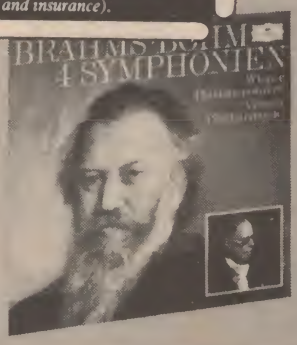
LISZT

The Complete Hungarian Rhapsodies plus excerpts from the remarkable 'Opera Paraphrases'. Played by pianist Michele Campanella.



The Rhapsodies are a mixture of gypsy and folk music from the Balkans, together with Liszt's original music. As piano works they reveal his masterly knowledge of the instrument and his wonderful feeling for tonal colour. They are amongst the most popular works in the piano repertoire. Recorded by Philips.

BRAHMS



Symphonies 1, 2, 3, and 4 played by the Vienna Philharmonic Orchestra under Karl Bohm.

Brahms, to a greater extent than any other composer, brought classical-romantic music to its logical conclusion. The fourth symphony was responsible for his last — and greatest — musical triumph in Vienna in 1897 when it was performed under Hans Richter. This, and the three preceding symphonies, truly reveal Brahms' might as a symphonist. Recorded by Deutsche Grammophon.

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- ☐ TCHAIKOVSKY
- ☐ LISZT
- ☐ BRAHMS

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FOR SALE: No. 12 ex-army transceiver plus one carton radio valves. Write J. Rees, 1/1 Fairy St. Gwynneville NSW 2500.

WANTED: XTAL Filter 9MHZ SSB 90dß stopband equivalent KVG-XF-9B SEI QC1246AX or parts suit 1974 Plessey SL600 transceiver exciter VK7ZTC QTHR. Phone (002) 27 8983 a.h.

AUSTRALIAN Radio Dx club, for shortwave and mediumwave Dxers. Monthly magazine published. Write for details to ARDXC P.O. Box 79, Narrabeen NSW 2101 enclosing a 30¢ stamp.

AUDIO

MELBOURNE Audio Club meets and shares with people a common interest in Hi-Fi, Music and Audio demonstrations. For further info ring AH (03) 561 5128 or (03) 232 6811.

FOR SALE: International 422 stereo amp 50 W/C H $100 o.ß.o. Ph (052) 78 2525.

FOR SALE: Amcron ICI50 pre amplifier with handbooks and factory test report. Very little use. $295 (03) 211 4026.

WANTED: TEAC A21 cassette deck & service manual, Sony ICF 7800 pocket radio, Sinclair pocket T.V. Phone (02) 43 2698.

FOR SALE: ETI427 Equalizer. Works. No cover. $80. (02) 449 4186 or P.O. Box 243, Pymble, NSW 2073.

WANTED: Output transformer 10 000 ohms C.T. to 3 ohms. Suit push pull 6AQ5 s. Phone Tom Cousins (02) 467 6503 business hours.

MISC.

WANTED: Circuit diagrams of b/w T.V.s pre 1974. Especially H.M.V. PR/2, PL3/BC and VA-E5 Hybrid chassis. State price. D. Watson, 5 The Avenue, Alstonville, NSW 2477.

WANTED: Valves, European, 8 pin lock in base ECH21, EF22, EBL21. G. Bracey, Exeter P.O., West Tamar, Tas. Phone 94 4126.

SELL: 14 44 pin sockets $10. 6 comp. boards (130 ICs, many resistors, caps, diodes $10. E. Jackson, 85 Bookpurnong Tce., Loxton 5333.

WANTED: T.V. Tank Game, AY-3-8710 IC wanted. Mike Springett, 13 Windsor Tce., West Beach 5024. Phone (08) 356 5010.

COLLECTOR disposing of antique radios, valves, parts, books. Will pack & rail. Box 222, Alderley, 4051.

COMPUTERS

FRIDEN Flexowriter I/O U/L case, with 8 channel paper tape punch and reader, 240 V motor, brown model, $125. Others from $60. R. Long (02)27 2982 a.h.

SELL: Chain printer, stand, power supply manuals $650 and ASCII Flexowriter with punch needing attention $150, Geelong (052) 75 1108.

TRS-80 owners. Use a light pen with your computer to communicate directly with the screen. No modification or expansion interface needed. Also telephone dialer, I/O controller. For more info write C/- P.O. Box 122, Bondi Beach, 2026.

TI speak and spell circuits and any details on interfacing it to a uP wanted. Geoff Cohen, P.O. Box 73, Lyneham, ACT 2602. Ph (062) 49 3493 (w), 54 7608 (h).

TRS-80 sound synthesizer based on Texas Instruments Synthesizer. Plugs in, simple to use, generates any sounds you want. $65 or best offer includes power supply, notes, etc. R. Gareb, 17/37 O'Donnell St, Bondi, 2026. Ph (02) 30 8261.

APPLE II program exchange. Non profit. Send program and receive one. Disk or tape. Ring or write. Laurie Boshell, 47 Martin Place, Linden 2778. (047) 53 1032.

IMSAI Video Board with monitor PROM, optional graphics capability, second character set (e.g. APL), $350 assembled and tested with cable. A. Tan 787 1706.

VECTOR Graphics Bit Streamer I/O board, one serial and two bidirectional parallel interfaces and 20 mg current loop, $200. A. Tan, 787 1706.

WANTED: Printer 110 baud, must be ASCII. Manual required rs 232c interface. Phone (049) 46 8404 after 6pm.

USED computer or kit wanted, suit learner. Please phone C/- H. Jones (02) 871 5932.

SELL: SWT KBD-5 keyboard inc. case, power supply, serial interface, $120. DG-640 VDU board, $120. Both assembled and working. Gary Brunckhorst, (07) 263 4404 a.h.

WANTED: Exidy Sorcerer, any sized system. Sell: Box of components and hardware, $10. A.W.A. CRO, $15. Trevor a.h. (02) 713 2370.

PET Minicomputer - business keyboard, 16k RAM, tapedeck. Ample software including editor, assembler, diagnostics, all manuals, basic book. Worth $1900 - only $1400. Ring Chris 419 4424.

SELL: C1P with monitor, 16k RAM, cassette recorder, and lots of software e.g. chess. $1,150. R. West, 3/8 Spring Rd, Malvern 3144. Phone (03) 20 2150 5pm - 9pm.

OSI superboard or C1 owners in Wollongong area, swap programs and information, phone Paul (042) 61 5451.

EXIDY Sorcerer 8k, 6 mths old, perfect condition, $850. Phone Adelaide 264 1870.

SELL: 1200' and 2400' x 1" unused computer/video tapes, 10 for $25 freight on. Sample Reel $4. Phone (07) 376 1045 a.h.

ANYONE interested in running an accoustic coupler or modern based system for transmitting TRS-80 programs to one-another on a swap basis, write with your ideas, designs, etc and I will send you mine. Robert Gareb, 17/37 O'Donnell St, Bondi 2026.

SELL: Sinclair Cambridge Programmable Calc., and 294 progs: maths, general/ finance/statistics, physics, electronics. $40. E. Jackson, 85 Bookpurnong Tce., Loxton 5333.

FOR SALE: Level II 16 K TRS-80 computer. Complete with monitor & cassette, also includes games e.g. microchess, micromusic, space games and many more. $1 000. Brian Marshall, phone 387 2127.

CENTRAL DATA S-100 extender board, $95. Also Logos 8K static ram board, $90. Jeff Bills, 29 Berkley Rd, Ringwood Vic. Phone 541 2529 (b).

TRS-80 Level 1 games pack of 10 programs. Lunar Taxi etc. All with spectacular graphics, $12. M. Binet, 743 Huon Rd, Ferntree, Tas. 7101.

TRS-80 L2 program swapping. I have around 100 programs. Phone 639 7962 or write J. Hale, P.O. Box 192, Baulkham Hills, NSW 2153.

TARBELL phase-encoded cassette interface P.C.B. (S100) with manual, $100. Part assem. (I.C.s (L.S.) in sockets). Passive components reqd to complete software to suit Central Data 2650 avail. Jim (03) 560 3206 a.h. Mulgrave.

FOR SALE: 2 only new Shugart SA-400 minifloppy disk drives with cables, connectors, and manual. $390 each o.n.o. Phone (03) 435 0130.

UNUSED Semcon 8k/16k Eprom Board for Motorola based system, $100. M6800 applications manual, $8. M6800 3½k basic, $15. W. Geary, Koolan Island, WA 6733.

SELL: E.A. (4k) 2650 micro. 2k on board. E.A. VDU, cassette i/f, micro basic, assembler, plenty games. $435. R. Watters, 33 Captain Cook Drive, Willmot 2770. Phone 628 9187.

SORCERER: 32k owner would like to correspond with others. Swap programs and ideas on uses, publications, modifications, etc. P. Deckert, 61 Agnes St, George Town, Tas 7253. Phone (003) 82 1649.

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KITS for projects

WE GET MANY enquiries from readers wanting to know where they can get kits for the projects we publish. This list is a guide to suppliers of kits and components for ETI projects.

We have only listed the projects published in the last few years, with their dates of publication, so this page can also be used as an index, even though kits are not available for some of them (as far as we know). Any companies who wish to be included in this list should phone Jan Collins on 334282.

Printed circuit boards

Those suppliers listed against specific projects here are able to supply pc boards for those projects. Printed circuit boards for every project ever published in ETI are available through the following companies (to the best of our knowledge):

RCS Radio
651 Forest Rd
Bexley NSW

Radio Despatch Service
869 George St
Sydney NSW 2000

For current projects and a more comprehensive list of pc board suppliers refer to the Shoparound page in this and previous issues. This list will be updated roughly every four to six months.

Magnifying glasses may be bought at many general hobby shops, Newsagents and some stationary suppliers. Squint a little – it helps !

Series 4000 stereo amplifier

Complete kits of this popular unit, featuring the 470 60 watt modules, the 471 preamp and power supply etc, are available from the following suppliers (see Key below): B,E,F,R.

Key to Companies

- A Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077.
- B Bill Edge Electronic Agencies, 115 Parramatta Road, Concord (PO Box 1005, Burwood North 2134).
- C J. R. Components, PO Box 128, Eastwood, NSW 2122
- D Dick Smith Electronics P/L, Cnr Waterloo & Lane Cove Roads, North Ryde, 2113.
- E All Electronic Components, 118 Lonsdale Street, Melbourne, Vic 3000.
- F Tasman Electronics, 12 Victoria Street, Coburg, Vic 3058
- J Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000.
- K S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109.
- L Ellistronics, 289 Latrobe Street, Melbourne, Vic 3000.
- M Mode Electronics, PO Box 365, Mascot, NSW 2020.
- N Nabula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011
- O Orbit Electronics, PO Box 7176, Auckland, New Zealand.
- P Pre-Pak Electronics, 718 Parramatta Road, Croydon, NSW 2132.
- R Rod Irving, PO Box 135, Northcote, Vic 3070
- T Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville, Qld 4812.
- V Silicon Valley, 23 Chandos Street, St Leonards, NSW 2065.
- W Willis Electronics, 993 Hay Street, Perth WA 6000.
- Y Trilogy, 40 Princes Highway, Fairy Meadow, NSW 2519

Project Electronics

041 Continuity Tester . . . . . T,D,B
042 Soil Moisture Indicator. . . . . T,D,B
043 Heads or Tails Circuit (Oct 76) . F,T,D,E,A,B,L
044 Two Tone Door Bell (Oct 76) F,T,D,E,O,A,B,L
045 500 Second Timer . . . . . T,D,O,A,B
047 Morse Practice Set . . . . . T,D,O,A,B
048 Buzz Board . . . . . T,D,A,B
061 Simple Amplifier (Oct 76). . . . . T,D,O,A,B
062 Simple AM Tuner (Mar 77) . . . . . D,E,B
063 Electronic Bongos. . . . . D,A,B
064 Simple Intercom (Nov 76). . . . . T,O,A,B
065 Electronic Siren . . . . . D,O,A
066 Temperature Alarm (Dec 76) . . . . T,D,E,A,B
067 Singing Moisture Meter. . . . . D,B
068 LED Dice Circuit (Oct 76). . . . . T,D,E,A,B
070 Electronic Tie Breaker (Jan 77)
071 Tape Noise Limiter (Jan 78). . . . . F,E,L
072 Two-Octave Organ (Jun 78) . . . . . D,B
081 Tachometer (Mar 77). . . . . T,E,O
082/
528 Intruder Alarm . . . . . T,E,A
083 Train Controller
084 Car Alarm . . . . . D,A,B
085 Over-rev Alarm
086 FM Antenna
087 Over-LED
088 Hi-Fi Speaker

Test Equipment

132 Experimenter's Power Supply (Feb 77) . . . .E
133 Phase Meter (Apr 77). . . . . .E
134 True RMS Voltmeter (Aug 77) . . . . . .E
135 Digital Panel Meter (Oct 77). . . . . .E
136 Linear Scale Capacitance Meter (Mar 78) . . .E
137 Audio Oscillator (May 78). . . . . .E
138 Audio Wattmeter (Nov 78)
139 SWR/Power Meter (May 78)
140 1 GHz Frequency Meter-timer (Mar 78) C
141 Logic Trigger (Jan 79)
142 High Current Power Supply (Feb 79). . . . . .E
143 Curve Tracer (Jan 79)
144 Expanded-scale RMS Voltmeter (Jun 79)
148 Logic Test Probe (Jul 79)

Simple Projects

243 Bip Beacon (Apr 77)
244 Alarm Alarm (Feb 77) . . . . . F
245 White Line Follower (Nov 77) . . . . . F,
246 Rain Alarm (Apr 78) . . . . . F, L
248 Simple 12V to 22V Converter (Jul 78)
249 Combination Lock (Apr 79). . . . . .E
253 'Hot Potato' Game (May 79)
254 Egg Timer (Jun 79)

Motorists' Projects

316 Transistor Assisted Ignition (May 77) . . D,O,E
317 Rev Monitor Counter (Jul 77). . . . . .E
319 Variwiper MK II (Sep 78) . . . . . .E
320 Battery Condition Indicator (Apr 79) . . . D,E

Audio Projects

448 Disco Mixer(Nov 76
449 Balanced Microphone Amp (Nov 76). . F, J,E,L
450 Bucker Brigade Audio Delay Line (Dec 77)
451 Hum Filter (July 79) . . . . . F,D
470 60 W Amp Module (May 79) . . F,A,B,E,P,R,S
471 Stereo Preamp (June 79). . . . . F,A,B,E,P,R,S
473 Series 4000 Moving-coil Cartridge Preamplifier . . . . . F, J
480 50-100 Watt Amp Modules (Dec 76) . . . . . F, J,E,D,O,R,A,,B,L
481 12 V 100 Watt Audio Amp (May 77). . . . . .E
481 High Power PA/ Guitar Amp (Jun 77) . . . . .O
482 Stereo Amp (Jan 77) . . . . . O,E
482 Stereo Amp Part 2 (Feb 77) . . . . . O,E
483 Sound Level Meter (Feb 78). . . . . .E
484 Simple Compressor Expander (Jul 77) . . . . .E
485 Graphic Equalizer (Jun 77) . . . . . .J,E
486 Gowl-round Stabilizer (Nov 77). . . . . J
487 Audio Spectrum Analyser (Feb 78). . . . . .E
489 Audio Spectrum Analyser 2 (Apr 78) . . . .J,E
490 Audio Compressor (Dec 79)
491 Graphic Equaliser (Mar 79)
495 Transmission Line Speakers (Aug 77)

Miscellaneous

546 GSR Monitor (Mar 77). . . . . .E
547 Telephone Bell Extender (Jun 77) . . . . . .E
548 Photographic Strobe (May 77) . . . . . .E
549 Induction Balance Metal Detector (May 77). .E
550 Digital Dial (Aug 78 . . . . . .E
551 Light Chaser (Sep 78) . . . . . .E
552 LED Pendant (Sep 78)
553 Tape/Slide Synchroniser (Oct 78 . . . . . .E
556 Wind Speed/Direction Indicator (Dec 79)
557 Reaction Tester (Feb 79) . . . . . .E
558 Mast-head Strobe (Feb 79)
559 Cable Tester (Mar 79)
577 General Purpose Power Supply . . . . . .J
581 Dual Power Supply (Jan 77). . . . . F,E
582 House Alarm (Jul 77). . . . . .T,O,E,A
House Alarm — Installation Instructions (Aug 77)
583 Marine Gas Alarm (Aug 77) . . . . . E,E
585 Ultrasonic Switch (Sep 77) . . . . . R,O,E,T,L
586 Shutter Speed Timer (Oct 77). . . . . .E
587 UFO Detector (May 78)
588 Theatrical Lighting Controller (Nov & Dec 77 Jan & Mar 78). . .N
589 Digital Temperature Meter (PCB135) (Dec 77) . . . . . .E
590 LCD Stopwatch (Oct 78) . . . . . .N
591 Up/Down Presettable Counter (Jul 78). . . . .E
592 Light Show Controller (Aug 78) . . . . . .E
593 Colour Sequencer (Dec 79)
594 Development Timer (Apr 79)
595 Aquarium Light Controller (May 79)

Electronic Music

602 Mini Organ (Aug 76) . . . . . .O,E,D,B
603 Sequencer (Aug 77)
604 Accentuated Beat Metronome (Sep 77) . . . .E
605 Temp Stabilized Log-exponential Converter (Sep 78)

Computer Projects

630 Hex Display (Dec 76). . . . . E,A
631 ASCII Keyboard (Dec 78) . . . . . O,E,A
631 Keyboard Encoder (Apr 77). . . . . O,E,A
632 Video Display Unit (Jan-Mar 77) . . . . . O,A
633 TV Sync Generator (Jan 77). . . . . E,A
634 8080 Educational/ Prototyping Interface (Jul, Aug 78)
635 Microcomputer Power Supply (Sep 77)
637 Cuts Cassette Interface (Jan 78). . . . .V,O,E,A
638 Eprom Programmer (Jul 78). . . . . E,A
639 Computerised Musical Doorbell (Mar 78) . . .A
640 S100 VDU (Apr, Jun 78) . . . . . .V,O,A
641 S100 Printer (Sep 78)
642 16k S100 RAM Card (Feb 79) . . . . . .K
650 STAC Timer (Nov 78)
651 Binary/hex Trainer (Jun 79)

Radio Projects

712 CB Power Supply (Jun 77). . . . . O,E
713 Add-on FM Tuner (Sep 77)
714 VHR-Log-Periodic Antenna (Feb, Mar 78)
715 VHF Power Amplifiers (Nov 77)
716 VHF Power Amplifiers (Jan, Feb 78)
717 Crosshatch Generator (May 78 . . . . . .E
718 SW Radio (Oct 78) . . . . . .E
719 RF Field Strength Indicator (Nov 78)
720 2 m VMOS Power Amp (Jan 79)
721 Aircraft Band Converter (Mar 79). . . . . D,E
722 Antenna for ETI-721 (May 79
724 Microwave Oven Leak Detector (Jul 79). . . .D

Electronic Games

804 Selectagame (Nov 76 . . . . . .O
804 Selectagame (Rifle Project) (Mar 77). . . . .O
805 Puzzle of the Drunken Sailor (Oct 77)
806 Skeet (Jan 78)
810 Stunt Cycle TV Game (Jun 78) . . . . . O,D,B
811 TV Tank Game (Oct 78). . . . . .O,E,D,B
812 Wheel of Fortune (Dec 79)
813 Race Track Game (Jan 79)

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DREGS

ASTRONOMY must be a tough science. Intrepid, even. Its practitioners need to be hardy men of resolute forebearance, if we take heed of a recent incident which occurred at the site of the UK infra-red telescope located atop the 4200 metre summit of Mauna Kea in Hawaii.

Three astronomers were ensconced on the mountain top going about the business of observing, this particular night. In the course of the evening they were hit by the worst storm to strike Hawaii in 100 years!

Deciding to abandon work for the night — an imprudent move — they made to retreat to the sleeping quarters, some 1500 metres below . . .

Their usually reliable four-wheel drive truck refused to start.

The strong winds cut off all electricity supplies and the telephone. The mountain road was washed away by the heavy rain.

There they remained for four days and nights . . . until rescued.

Despite this harrowing episode there remains a great queue of astronomers keenly interested in using the facility.

Like I said — a tough science, pursued by intrepid practitioners of resolute forebearance.

Red faces dept.

June and November 1976 were **two bad months** for certain staff members of our illustrious rival E..... A..... Their June cover that year featured a NordMende 1800 colour telly — but who do you think was shown operating it? Electronics Today's very own advertising sales manager, (then) Howard Jenkins!

It seems that Howard was out at NordMende one day, and being a particularly handsome sort, was called on to pose for a press pix . . . which E..... A..... ran as a cover! Then, damn it, if they didn't do it again five months later — Page 26 of their November issue included a pix of the British Post Office's Viewdata system — this time the model (chosen for much the same reason as before) was the UK Electronics Today's advertising sales manager Bob Evans.

Thanks fellas — wonder why you didn't include the models' names?

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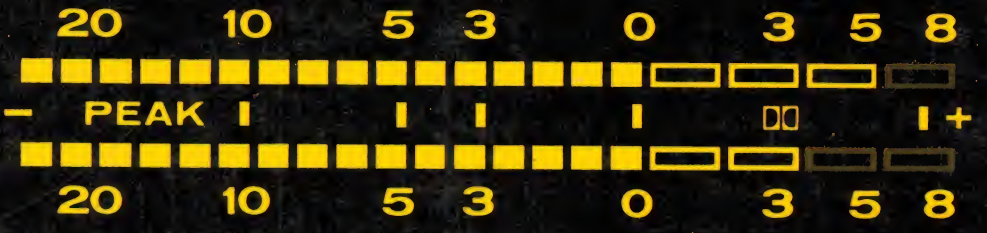

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